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EDITORIAL NOTES.

Coal Traffic.

GAS undertakings, down south especially, are, in relation to their coal supplies, feeling rather acutely the congestion of traffic on the railways; and so it was a satisfaction to learn from the correspondence between the Institution of Gas Engineers and the Railway Executive Committee, as published last week, that every endeavour is being made by the latter to maintain the supply of coal to gas-works. The London and Suburban companies who are dependent upon seaborne coal have not yet been greatly affected, except by the regulations of the Admiralty, which compel the laying-up of steamers at night time, and so cause delay in the journeys to and from the North, and thus a shrinkage in deliveries, with the result that the companies are about living from hand to mouth in respect of coal supplies, and have no present margin with which to supplement stocks held against emergencies. And, of course, one can never tell when there may be further restriction by sea, which would, if prolonged, inevitably mean a heavy additional demand upon the already congested railways by the Metropolitan and the Thames-served and coast-situated gas companies. There is room for very considerable improvement in traffic by water and railway, in order to assure the safety of coal supply, and therefore the provision of light, heat, and power by means of gas. There is some fear, however, that, though there is plenty of coal available up North, the position may temporarily be rather worsened than bettered, owing to the fact that certain railways are expected to be closed to mineral traffic during near weeks.

But no stone is being left unturned by those representatives of the gas industry who have immediate access to the Railway Executive Committee, who, it is quite plain, realize the importance of the maintenance of the provision of coal to gas-works and similar public supply industries. Of course, even supplies to such industries must be subordinate to military exigency; and the question for consideration is how best an improved service can be assured, without interfering with military transport necessities. It is stated by the "Iron and Coal Trades Review" that there was what was understood to be a Board of Trade conference with representatives of the industry last Wednesday, when the piquant suggestion was made that interned enemy vessels should be employed to relieve the shipping situation generally. The idea of captured enemy vessels being utilized to serve our needs is one which has a smack of irony about it which rather pleases the patriotic mind. The correspondence published last week, too, shows that the Railway Executive Committee place upon consignees the obligation of helping to relieve the position in regard to overland transport by asking them—and it is their duty to do so—to release trucks at the earliest possible moment after they are placed in position. With the same end in view—the prevention of the locking-up indefinitely of railway trucks—the Railway Executive Committee announced some days ago that no coal or coke consignments could "until further "notice" be accepted unless the waggons were labelled from collieries to their ultimate destinations. It is asserted that thousands of waggons are constantly idling away their time through awaiting the necessary relabelling by inland factors to final destination. There is admittedly a convenience in this "wait order" form of traffic to both collieries and factors, the former of whom through it keep their own sidings fairly clear of trucks, and the latter have available supplies ready for immediate dispatch to purchasing quarters. Further relief is being sought by the reduction of the number of passenger trains at periods of "light loads" during the day. Notice of quite a large diminution of service was issued yesterday on the South-Eastern and Chatham Railway. Just now individual convenience has to give way before national convenience. It is, however, hoped that the discussion and two-fold pressure—pressure from the Railway Executive Committee, and pressure from large coal users—will result in substantial amelioration of transport shortage which it is recognized has become a grave one in the present situation.

Parliamentary Applications of Local Authorities.

THE Bills which have been lodged by local authorities for consideration this session, and which deal in whole or in part with gas matters, are, generally speaking, in this regard of a particularly lean kind. The most important from the gas point of view are those emanating from Chelmsford, Lurgan, and Skegness. The three propose the purchase of the local gas-works; but seeing that the Chelmsford Corporation and the Skegness District Council are in Parliament—in the former case in pursuance of an agreement effected with the Gas Company when in Parliament last session, and in the latter case in consequence of the purchase clause conferred in the second House when the Gas Company's Bill was under consideration—it cannot be anticipated that these Bills will have anything more than a formal run through Parliament. The Lurgan transfer is also to take place under already agreed terms. In three of the Bills—Chelmsford, Plymouth (in respect of the Devonport works of the Corporation), and Skegness—an illuminating power standard of 14 candles is being sought. In the case of Skegness, the Company last year obtained a calorific standard; and why the Council now think it necessary to statutorily restore the illuminating power test is not altogether clear. They could work to any figure that pleased them without having it put down in black and white in an Act. The proceeding is quite superfluous; but the Council appear to be obsessed by the importance of having a statutorily imposed dual standard, for that was one feature of their ill-fated Purchase Bill of last session. The Dewsbury and Doncaster Corporations are asking for a calorific power standard and test on the model lines of 540 B.Th.U., with a margin of 7½ per cent. On the other hand, the Lurgan District Council suggest, similarly to certain companies whose Bills were noticed last week, that they shall have a level standard of 500 B.Th.U., without a margin. We do not know whether coming events are casting their shadows before them in the Dewsbury and Doncaster Bills; but both Corporations are asking for power to purchase in bulk gas in a crude or partially purified state. The same clause appeared in the Middlesbrough Corporation Act last session; and, as articles in the last two issues of the "JOURNAL" have shown, Middlesbrough is now purchasing in a partially purified state a large volume of gas daily from neighbouring coke-ovens. There are no other gas features of general importance in the local authority Bills.

Electrical Plants for Gas-Works.

RECENTLY some attention has been bestowed in our columns upon the question of the electrical driving of gas-works plant. No excuse is required for having done so, nor for the intention of continuing to do so. This method of operation has now, through the special conditions, taken an important place in gas-works practices; and in the greater number of the more important gas-works of the country, experience is being constantly accumulated, which may have a marked effect in future on the fortunes of the gas industry, if only those in power do not miss their opportunities. One effect of this large installation of gas-driven electricity generating plants on gas-works is that we have growing up among us a considerable number of young gas-electrical engineers; and the influence of their training and experience may have an untold bearing in the time to come in widening the scope of the business of the industry—even probably to in some areas the bringing about (gradually it may be) of that consummation of the advanced thinker in these matters, the instating of the gas-works in the position of being the sole place in an urban

district at which coal is used on a large scale, and therefore the source from which the electricity purveyors will draw the necessary fuel for the driving of their primary engines. We cannot tell what in this respect the future holds in store. From small beginnings large issues spring. And who can say what important result may cap the small introductory use of a few years since of electricity for the propelling and operation of retort chargers and dischargers!

However, that is a matter which rests a distance ahead. But it is among the possibilities, and so should not be lost sight of. On the contrary, the idea should certainly be encouraged. Meanwhile, there are considerations applying to the installation of electrical plant upon gas-works over which the technical men of the industry should pause. When electrical installations were originally made on gas-works, it must be confessed that most gas engineers had a very rudimentary knowledge of the science of electricity and of the generation of electrical energy. What happened? The electrical plant installed was largely left to the determination of the gas-plant contractors, who obtained what was necessary for the operation of the particular apparatus constituting their contract from one or other of the suppliers of dynamos, switchboards, motors, &c., using in most instances gas-engines for generating purposes. Generally speaking, these electrical sets were—it is true they were mostly in duplicate—only designed with a view to driving the plant contracted for at the time; and the gas engineer had little or no choice, owing to the lack of the guiding knowledge, as to type and size of the plant put in. The contractors did their best, and, under the circumstances, things went very well then, save that in some instances, owing to the poorness of the load factor, there was not the economy which a new order of things has since produced. The contractors have added to their knowledge of electric operation; gas engineers have added to theirs. Now the time has arrived when, more generally, there should be greater control on the part of gas engineers over their electrical installations in the cause of works' economy; for if an electrical plant is to be operated to the highest attainable efficiency, it must be accorded those conditions which subscribe to that end, and a single retort-house and a telpher plant may not alone provide these conditions. In fine, the installation to-day of an electrical plant upon a gas-works should be a matter of consideration, altogether independent of the main purpose to which the energy produced is to be applied. This main purpose should be the chief, but only one, consideration; and no contractor for (say) a new retort-house and coal and coke handling plant would have (and has not had in certain cases) any objection to receiving a specification for an electrical plant to drive apparatus upon the gas-works other than that for which he is contracting, for it follows that whatever economy can be achieved by improving the load upon the electrical plant will redound to the credit of the operating costs of the retort and coal and coke handling plants.

Those gas engineers who have not an electrical plant upon their works, but are likely to have one some day, have the advantage now of being able to profit considerably from the experience of other gas engineers. One engineer associated with a large gas-works who has made special study of electrical operation for gas-plant purposes, and the bearing of the matter upon the economic conditions of a gas-works, starts in our columns to-day a short series of articles on the subject, which he hopes will be helpful in preventing mistakes and unnecessary initial expenditure, and in raising the economy of operation. As he says that mistakes made in the initial installation of plant are frequently most difficult to rectify when once it is put to work, and often result in a part of the plant, if not the whole of it, operating under inefficient and hence uneconomical conditions. One of the mistakes in the past has been the installation of too small a plant; and so no scope is provided for raising economy by doing anything to improve the load factor. This is where a study of conditions on the part of a gas engineer who is responsible, and who is acquainted with his own works as no contractor can know them, may lead to very considerable economies. It does not, however, necessarily follow that the more plant on a gas-works one can get on to the electric drive the better. One wants to work to the best realizable load factor which can be maintained, without having high peaks in the demand curve. The diverse plant on a gas-works which can be electrically operated gives the gas engineer a good margin of play in this regard. Again, on some gas-works we have seen duplicate generating plants that are as alike as two peas from the same pod. This may be a mistake. A gas engineer, if he knows his subject, can determine whether this is so better than a contractor. Some engineers maintain that each generating plant, in case of the breakdown of one, should be equal to the maximum demand. That is good up to a point. It is hoped that breakdowns at the generating end are not going to be of frequent occurrence; but the maximum attainable economy is a matter that applies to every day and to every hour. Therefore, seeing that the plant at work during the day supplies the motors driving the coal plant, and probably a number of machine-tools as well, which are not in operation probably more than seven or eight hours out of the twenty-four, the second or night plant might be of smaller capacity, and yet be adequate to run the retort-house or other indispensable plant in a day emergency, or while effecting repair. These are matters that the gas engineer has to take into consideration, in conjunction with the present power conditions of his works, to ascertain how far there is real value in effecting a conversion from steam or gas, in order to raise the economical operation of the electrical plant. They require very careful, comprehensive consideration from the profit and loss point of view; and our contributor discusses the various questions involved in a manner which will aid to determination.

It will be found that the articles treat of the type of plant to be adopted; and reasons are given as to why direct current is better than alternating current under the conditions of motor operation on gas-works. The relative claims of steam and gas for driving generating plant are noticed. It is shown that, when the generating sets are small, the horizontal gas-engine has much to recommend it, while, when the sets are large, the multiple cylindered vertical gas-engines are highly efficient and steady running. Among other topics considered are the power required and the costs, switchboards, single pole *versus* double pole, transmission, motors, standardization, motor control gear, electrical driving of exhausters, plant operation, insurance, and the question of policy. This is a syllabus of the subject-matter composing the articles, which, we have confidence, will be found very useful. Of this we are also sure, that if any point arises out of the articles which any of our readers would like to discuss, our contributor would be pleased to deal with the matter through the "Correspondence" columns of the "JOURNAL."

Constructional Details.

THE stability of any structure lies largely in the attention given to details; the greatest weakness, in their neglect. But it is impossible in engineering work to reduce detail, under all circumstances, to compliance with any common rule. There are, however, considerations in connection with the carrying-out of structural work that may have more or less general application; but even in these respects, there should not be slavish acceptance or application under all conditions. Certain of these considerations, Mr. F. Gorman compounded into a paper which he read before the Midland Junior Association on Saturday, in the hope that they would be useful, especially to young engineers anxious to learn details, and how to get best value for money. Generally speaking the considerations incline to the elementary, and, in the main (eliminating Mr. Gorman's personal convictions as the result of his experience), they ought to be already the possession of every young engineer or clerk of works who is worth his salt. But as a matter of fact, some of the details mentioned would not be left to the discrimination of a young engineer or clerk of works, but would be part and parcel of the work specified by the responsible engineer whose business it is to get full value for money expended. If the responsible engineer left certain of these details to the discretion of a subordinate, he might find some instability about both his structure and his reputation before very long. All the same, the young engineer will himself in time become the responsible engineer; and the value to him at all stages of his career of a knowledge of details such as Mr. Gorman presents, must be recognized. Any young engineer reading and studying this paper cannot do better than follow it up by reading, or re-reading if he has previously perused it, the lecture delivered by Mr. W. R. Herring at the Manchester University early in 1913. For while the present paper largely represents the elementary stage, Mr. Herring's lecture represented the advanced stage.

It seems almost incredible that it should be necessary to say to anyone who professes and calls himself an engineer,

that the preparation of drawings should always be considered well in front of the time when the actual construction is to take place, so that any detail can be fully discussed. But Mr. Gorman says it, and adds further the obvious, that the rushing through of designs or specifications, may be [he says, "is"] fatal. The same applies to the advice that the work of contractors should be carefully supervised. An engineer is not burdened by an excess of conscientiousness in regard to his obligations if he sets up his confidence in the contractors as fully discharging him from the duty of protecting the interests of those whom he is called upon to serve. However, such points as these are rather in the nature of a prelude to the main part of the communication. From here the author shows his grip of practical detail. He treats of the depth of foundation work. This is a matter that is largely left to circumstances when the nature of the subsoil is ascertained, which is usually when the work is put in hand. "A sure-and-fast rule, such as always to seek a "firm sand or gravel bottom, is good; but economy is often "sacrificed by reaching a gravel bottom without much "additional safety." There are really no sure-and-fast rules that can generally apply to trench excavations for structural foundations, for it is remarkable how on even a single site there may be a wide variability in the subsoil through which trenches are cut. Decision as to depth and other matters must be subject very much to experience.

So we have the author in his paper urging that a young engineer who has not had the necessary experience would do well to take the advice of the ganger who has charge of the excavating, and, if only he combines this with his own common sense, difficulty will be overcome. It is evident here that Mr. Gorman has merely in view work of a comparatively small and shallow character; and consequently to his statement there should be affixed qualification to act as a warning under circumstances of larger importance. The Departmental Committee of the Board of Trade who sat in 1910 to consider the possibility of subjecting work of this nature to general prescription reported that it is impossible to lay down rules and regulations for trench work excavations not greater than 10 feet deep. But beyond this depth it is now necessary to employ a person of wide experience *above the ganger* in charge of the work. Again, we read in the paper that "wet-foundation work is always an "evil; but unnecessary labour is very often used in coping "with the inrush of water." In counselling young engineers in this matter, we should not in any way use words that might have the effect of minimizing the importance of methods of dealing with "inrushes" of water. We know very well that Mr. Gorman had no such intention; for what he says is true in some circumstances. But it is equally true that the engineer should take the best possible precautionary measures against water difficulty, and, when it arises, his resources should be equal to dealing with it, and in manner which comprehends consideration for any proximate structural work. It is quite easy by improper methods of dealing with water-logged subsoils when making excavations, to affect the foundations of other structures in which there may be heavy plant installed. It is not always merely a question of a sump-hole, and keeping the water down in the excavation in which work is proceeding; but it is frequently necessary in this matter to look beyond the immediate necessities of that work. For this reason, it is well to avoid counsel that appears, although not intended, to in any way minimize the importance of conditions which may or may not be of particular gravity in respect of effects.

The remarks in the paper on piles are good; those on concrete are characteristic of approved practices; but it is curious that, in a paper of this kind, in view of the large application of reinforced concrete on gas-works to-day, we do not observe any reference to it. Emphasis, however, may be given to the protest contained in the following passages: "When dealing with concrete, it is a common thing "to find engineers still referring to the proportions as 6 to 1, "8 to 1, &c. I would strongly advise everyone to avoid this, "as it is most misleading. For instance, 6 to 1 can be 1 "cement, 5 broken brick, and 1 sand, or 4 broken brick, 2 "sand, and 1 cement, the difference in the strength of which "will be seen." The importance of good mixing, and of the constituent materials of concrete being such as are best adapted for circumstances and situation, surely do not to-day require any reiteration. Text-books and papers have so often gone over these details that, if a student has missed them, he has not been placed in possession of modern literature on the subject. In the sections of the paper treating of bricks and mortar and steel structures, there are several points which are well worth making note of, and on occasion putting into practice.

Important Sulphate of Ammonia Move.

A short time since the Sulphate of Ammonia Association issued a circular-letter on the subject of the quality of sulphate of ammonia, in which it was shown that the making of sulphate of 25 per cent. ammonia quality, and containing not more than 3 per cent. of moisture and ½ per cent. of free acid, is not now a matter of option, but is a real necessity to the maintenance of British trade in the commodity. In other columns to-day (p. 99), there is in a letter from the Chairman of the Association (Mr. D. Milne Watson) reiteration of this necessity, and appended to his communication is a copy of a letter from America which shows how near we were to losing the American trade just before the war, solely on account of the poor position in which the British produce qualitatively stood in relation to that of German origin. This, as statistics indicate, we cannot possibly afford to lose. The letter is a warning to "make good" while the war lasts, so that, before it ends, our sulphate of ammonia is so strongly entrenched in the good opinion of our American customers that German makes will not be able to effect its eviction. The Sulphate of Ammonia Association are taking a very practical step in this direction. They—and no one is in a better position to do so—realize the pressing importance of the matter; and in order that small works as well as large may bring their product up to standard, they are engaging an expert foreman sulphate of ammonia maker, whose advice on working methods and plant design will be given free—only the refunding of travelling expenses from and to Westminster being asked from undertakings that are members of the Association, and that desire the services of the expert. The new adviser should have a busy time. Enclosed with Mr. Milne Watson's letter are some plainly stated suggestions (which we have also reproduced elsewhere) for the manufacture of high-grade sulphate of ammonia. These suggestions are presented under the headings "Purity of Materials," "Control of the Still," "Control of the Saturator," and "Draining and Drying." With regard to the purity of materials, and the discoloration of salts, articles bearing on these subjects appeared in the "JOURNAL" for March 24 last (p. 831) and April 14 (p. 108), with a correction bearing upon the latter in a subsequent issue (p. 262).

The War and Coal Exports.

In the "Retrospect" published in the final number of the "JOURNAL" for last year, an indication was given as to the effect the war had been having on coal exports; but with the issue last week of the returns relating to our foreign trade during December it is now possible to see the total effect of the war upon coal exports. It is perhaps not so large as may have been anticipated. For the whole year, the reduction amounts to 15 million tons (including relatively small quantities of coke and patent fuel) of a calculated value of £11,458,532. In 1913, the quantity of coal exported was in the neigbourhood of 73½ million tons; so that the total draft upon our supplies from oversea quarters during 1914 amounts to about 58½ million tons. Up to the end of July, there had been a lessened shipment amounting to 1,257,007 tons; while during the war five months, the exports receded by 13,608,754 tons—this figure being made up by a reduction in August of 2,872,473 tons, in September of 2,405,125 tons, in October of 2,908,547 tons, in November of 2,775,609 tons, and in December of 2,647,000 tons.

The Provision of Dyes and Colours.

The situation of this country in regard to the home supply of synthetic dyes and colours is getting more interesting than ever. At the moment, it is not at all certain that the well-intentioned scheme of the Government for the formation of a 4½ million company (into which the Government themselves are willing to put 1½ millions at 4 per cent., provided that those who require the dyes find the other 3 millions) is going to sail through without considerable opposition. While the scheme has the support of a number of influential men, and it is known that it will start (if successful in getting so far) with the control of certain good contracts, there are other men who appear to desire to

wreck the project for something else which they think preferable, although the Government scheme was not put forward without the weightiest consideration between their representatives and men in the chemical and dyeing industries who are steeped in all there is to be known as to the *pros* and *cons* of the question. There seems to be a want of patriotism and of loyalty among the objectors; it may be that actually this comes from being shy of taking some risk. However, their reluctance to support the scheme as it stands shows itself in two forms. In the first place, it is thought that the Government are not sufficiently generous, and that they ought to guarantee the money invested (say) for twenty years. These objectors want to make the Government take upon themselves an extraordinarily huge responsibility; while if the industries concerned, with a turnover of 200 millions a year, and employing 1½ million workers, would only find the remaining 3 millions of capital, this would be a sufficient guarantee of custom which would give the requisite security for the investment. There would not be much risk under such circumstances.

A Tariff or Co-operation.

Another criticism is that the scheme will stifle competition and establish a monopoly. "Competition" and "monopoly" are terribly obstinate words to handle in ordinary commercial controversy. The really important thing, however, is the question of ways and means of dealing with an unusual situation. The present manufacturers cannot be expected, without guarantees for the future, to embark upon the necessary manufacture of dyes and colours to fill the enormous gulf represented by an import from Germany to the value of £1,800,000 per annum. The objectors to the Government scheme think a huge tariff against German producers would provide the necessary protection for the home manufacturers, and enable them to indulge in unfettered enterprise and competition among themselves. What would then happen? After the manufacturers had spent considerable sums of money, they would still be exposed to German competition; for the German manufacturers would promptly, and without the fuss over the matter that is now being made at home, dump into this country the necessary capital for the establishment here of competing works, run under some good-looking British title. It comes to this, that the dye-provision question is too large to deal with in any but a special manner; and the best movement in the circumstances—the movement giving the greatest security for the future—is a co-operative one between producers and users. British coal-tar makers have little feeling in the matter; but naturally they would prefer to see their production absorbed as far as possible in this country, and put to really profitable use in its manufactures.

Striking Annual Coal Figures.

When remarking that the complete coal figures for the year 1913 contain some striking features, the statement is not intended to be taken in the same sense as it would have been had one applied it to the preceding twelve months, when the miners all over the country were idle for some six weeks, in an endeavour to impose their will on the employers, through the people. The reduced output in 1912 which resulted from this action of the men was amply compensated for by that of the following year, which easily topped previous records in this respect, with a figure of close upon 287½ million tons. There will be found on another page of this issue some particulars taken from Part III. of the Home Office Annual Report on Mines and Quarries, which enable the relative positions of 1913 and other recent years to be clearly understood. Under the circumstances of the national strike, it would not be fair to make much of the fact that the output was 27 million tons more in 1913 than in 1912; but even when compared with 1911 (which at that time was a record output), it is seen that 1913 possesses an advantage of over 15½ million tons. The total value of the minerals raised in the United Kingdom in the latter year amounted to £160,112,667; and of this, coal accounted for £145,535,669—or an increase of £27,614,546 on the figures for 1912. In addition to the much larger output, the average price realized was over 1s. per ton more; having been 10s. 1·52d., as compared with 9s. 0·68d. in the year before. During the past forty-one years, the total value of the minerals raised in the United Kingdom has amounted to £3,519,117,049, of which £2,950,594,385, or 83·8 per cent., has to be placed to the credit of coal. The quantity of coal raised in this period has been 7940½ million tons; and of this, 1931¾ million tons, or more than 24 per cent. of the total production, has been shipped abroad as exports in the form of coal, coke, and manufactured fuel, and as coal used for steamers engaged in foreign trade. The proportion of coal so shipped to the total output exhibits a steady rise in each quinquennial period from 1873 to 1912, from 13·8 to 32·4 per cent.; and 1913 showed a still further increase to 34·2 per cent. The actual quantity shipped abroad in the last-named year was 98¼ million tons, which left something over 189 million tons (or 4·1 tons per head of the population) for home consumption.

PERSONAL.

Mr. E. Heath, of the Great Western Railway Gas-Works, Swindon, has been appointed Manager to the Wantage Gas-Works. Applications for the position were invited in the advertisement columns of the "Journal" three weeks ago.

At the last meeting of the Rochdale Gas and Electricity Committee, it was stated that Mr. T. Banbury Ball, the Gas Engineer, who is at Colwyn Bay, was not recovering from his illness as rapidly as could be desired, but that he quite hoped to return to duty at an early date.

Hearty congratulations to Dr. G. A. Jeffery, J.P., the greatly respected Chairman of the Eastbourne Gas Company, who is celebrating his ninetieth birthday. Some particulars of Dr. Jeffery's career and his connection with the Company will be found among the "Miscellaneous News" in this issue.

Mr. Eugene Allan, son of Mr. Fred Allan, Secretary of the Dublin Corporation Electric Lighting Committee, was last week appointed by the Corporation to the position of Superintendent of Public Lighting, City Gas Examiner, and Official Meter-Tester. Mr. M. Ruddle, the City Electrical Engineer, reported that Mr. Allan's testimonials disclosed satisfactory qualifications for both the gas and electrical sections.

Mr. F. W. M'Cullough, M.Inst.C.E., J.P., Chief Water-Works Engineer of the City of Belfast, who was unanimously elected President of the Institution of Water Engineers for the year 1915-16 at the recent winter meeting, is a native of Belfast, and has had a long and extensive practice as a water engineer in nearly every province in Ireland, having been concerned in the design and construction of many provincial water undertakings. But he has been more particularly responsible for the design and construction of the several extensive reservoirs, filters, conduits, tunnels, and other contingent works, in connection with the water supply of Belfast, where for the past eighteen years he has occupied his present position, and is now engaged in the preparation of the contract plans and specifications for the immediate construction of the extensive "Silent Valley" storage reservoir (to hold 3000 million gallons) in the Mourne Mountains, some 45 miles south of the city. In earlier years he was responsible for the design and construction of several sewerage, harbour, and railway undertakings in Ireland, and is the author of the first scheme for an "Irish Channel Tunnel," between the County Antrim coast in Ireland and the Wigtonshire coast in Scotland. Mr. M'Cullough has been a member of the Institution of Water Engineers since its formation. He was elected in 1889 a corporate member of the Institution of Civil Engineers, and for several years past has been a Justice of the Peace for Belfast.

OBITUARY.

The "Journal für Gasbeleuchtung" of the 19th ult. reports the death, in his seventy-second year, of Herr G. Franzius, a well-known German dock, harbour, and water-works engineer, who was responsible for the extension of the Kiel naval harbour and dockyard, and for the choice of Kiauchau Bay as a naval base in the Far East. Of late years, he had been a vigorous advocate of the utility of the divining-rod.

The death occurred last Friday, at the age of sixty-four, of County Alderman James Shuttleworth, J.P., who was for many years a Director of the Rossendale Union Gas Company. He was for six years a member of the Bacup Town Council, and for sixteen years upon the Lancashire County Council. He had resided at Bacup for upwards of forty years, and was an honorary freeman of the borough, of which he had been Deputy-Mayor. He was a Freemason, with Provincial honours.

Yorkshire Junior Gas Association.—We learn from the Hon. Secretary (Mr. Edward Garsed, of Kippax) that the next meeting of this Association will be held on Saturday, at the Bradford Corporation Gas Department Show-Rooms, by permission of the Engineer (Mr. Charles Wood, F.C.S.). Mr. E. J. Sutcliffe (the Deputy Engineer and Manager) will submit a paper entitled "Descriptive Notes on the Concrete Foundations for a Vertical Retort Installation;" and it will be followed by a short paper by Mr. J. W. Roper (of Bradford) on "Photometry of Incandescent Lamps and Burners." The members will then proceed to Mill Street Gas-Works to inspect the lamp-testing arrangements, &c.

DEATH OF COLONEL H. OAKDEN FISHER.

THE Cardiff Gas Company have just sustained a great loss by the death of the Chairman, Colonel H. Oakden Fisher, which took place last Tuesday afternoon, at his residence at Radyr, in his seventieth year. He had been in good health till a few months ago, when internal trouble developed.

Colonel Fisher was the second son of the late Mr. George Fisher, who was for many years Engineer, and afterwards Managing-Director, of the Taff Vale Railway Company. He entered the Company's service, and became Chief Engineer—a position from which he retired at the end of 1891, a few months after his father's death. He became a Director of the Cardiff Gas Company about seventeen years ago, and his activities on behalf of the Company and the gas industry never ceased. He succeeded the late Surgeon-Colonel William Taylor in the chairmanship in the spring of 1912; and at the time of his death he was Chairman of the Rhymney and Aber Valleys Gas and Water Company, the Garw and Ogmore Gas Company, and the Tawe Valley Gas Company. He was one of the founders of the British Commercial Gas Association, of which he was a Vice-President; and was present at the conferences of the Association held in Manchester and London. Members of the Wales and Monmouthshire District Institution of Gas Engineers will have pleasant recollections of deceased in connection with their meetings at Cardiff.

Colonel Fisher's training as a civil engineer, coupled with his experience in railway matters, were of the greatest use to him in dealing with gas affairs; and his technical knowledge was freely placed at the disposal of the profession. He was held in the highest respect and esteem by the Company's workmen; and no social function was considered complete without his genial presence. He was a consistent advocate of everything that tended to improve the workers' lot, and heartily supported co-partnership principles, recreation clubs, and sports among employees.

In connection with military work, Colonel Fisher had a long and notable career as a Volunteer. He was an ensign in 1866, was captain of the Glamorgan Volunteer Artillery in 1870, was promoted to the rank of major in 1890, and to that of lieutenant-colonel in 1893. He was in command of the battalion for fourteen years, and retired in 1907 with permission to retain his rank and uniform. He held strong views regarding the duty of citizens, and thought every man between prescribed ages should be compelled to give up a certain amount of time to physical drill.

For some years Colonel Fisher was a member of the Glamorgan County Council; but of late years he did not serve upon any publicly elected body. In other ways, however, he was prominent, especially in connection with the Cardiff Horse Show, the Conservative organizations in South Glamorgan and Cardiff, the Glamorgan Territorial Association and its Committees, and the King Edward VII. Hospital. He was placed on the Commission of the Peace for the County of Glamorgan in 1896, and frequently attended at the Llandaff Court.

Colonel Fisher made a study of agriculture on up-to-date lines, and was a member of the Glamorganshire Chamber of Agriculture. He also took a keen interest in sport, was a member of the Glamorgan Hunt, and until recently followed the hounds.

The funeral took place last Friday in Radyr Parish Churchyard, amid general manifestations of sorrow. The chief mourners were Captain H. B. Fisher, of the Wiltshire Regiment, Lieutenant Oakden Fisher, of the Glamorgan Yeomanry, and Lieutenant Phillip Fisher, of the Glamorgan Yeomanry (sons); Messrs. William Bruges and Alex. Ware (brothers-in-law); and Lieutenant Wyndham Ware. The fourth son of the deceased (Major H. G. Fisher) is on active service with the Royal Field Artillery. Among those present were Messrs. W. Morgan Lewis and Lawrence G. Williams (Directors), Mr. George Clarry (Manager and Secretary), and Messrs. H. D. Madden, R. J. Oakland, J. K. Evans, G. Phillips, R. Barnet, and R. Boyer, of the Cardiff Gas Company; also representatives of the Rhymney and Aber Valleys Gas and Water Company, the Tawe Valley Gas Company, the Garw and Ogmore Gas Company, and other bodies with which the deceased was associated. Many officers attended to testify to the high esteem with which their late Colonel was held in military circles round about Cardiff.

In addition to the four sons already named, the late Colonel Fisher leaves a widow and one daughter, who is now actively engaged as a Red Cross nurse.

British Commercial Gas Association.

"F. W. G.," glancing over the year 1914, in the "Bulletin of the British Commercial Gas Association," asks how the Association has stood the test of 1914? Its answer is: Judged by all the tests that can be applied—the opinions of members within, the comments of observers without, the continued support of all the former subscribers, and the steady influx of new subscribers—it can fairly be said that the sudden crisis which came upon the commercial world in the first weeks of August had no weakening effect upon the Association, and that the end of the year sees it stronger than ever before. Seeing that its active life is considerably short of three years, it is satisfactory to find that the roots have already struck so deep that the tree is able to weather the fiercest storm.

THE GAS INDUSTRY AND THE WAR.

The issue of the "Co-Partners' Magazine" of the Gaslight and Coke Company for January opens with the Governor's New Year's Greeting. In the course of his remarks, Sir Corbet Woodall says: "Last year I spoke of the industrial differences in the country, and of the distress which they were causing. I ventured to say that patriotism was at a low ebb, because employers and employed fought for their individual interests without adequate consideration for those of the common country. This was true at the time, and may prove itself true again; but the way in which all classes of the community have sunk their differences, and become one, in face of a real peril to our land and people, should make us proud—has made us proud—of our nationality, and goes some way to reconcile us to the terrible sacrifices of war. Our Company are suffering heavily. It has been found necessary to limit greatly the facilities for transit by sea and land. The Government require, as a matter of national safety, that the streets of London and the premises upon them shall be kept in comparative darkness; and the consumption of gas has thus been greatly reduced. The price of gas has been increased; but only when the increase was absolutely necessary. This will cause a reduction in the shareholders' dividend and in the co-partners' bonus. We will all, I am sure, try earnestly to bring back the former state of things and improve upon it as early as possible."

A handsome Christmas card, accompanied by a gift, was sent by the Directors of the Gas Light and Coke Company to their men on service. The front leaf bore, sunk on vellum, the wish "A Happy Christmas," with the Royal Ensign and Union Jack in proper colours and gold, crossed, over the lines "We'll Meet the Future Full of Faith and Hope." Inside was the message, "With Hearty Christmas and New Year Greetings from the Governor and Directors and your colleagues of the Gas Light and Coke Company, who think of you, are proud of you, and hope to welcome you on your return to peaceful duties at a not long-distant date."

The Government dye-ware scheme was considered last Friday by the Directors of the Leeds and District Dyers' and Finishers' Association. After full deliberation, it was decided to intimate to the Board of Trade that the proposals of the Government are not acceptable to the Association, and that the latter cannot see their way to support the scheme in its present form. It is understood that, while the Directors were willing to support any reasonable scheme, it was felt that the Government's proposals, as they now stand, differ materially from those which were brought before the meeting at the Board of Trade Offices on Nov. 10. It was then assumed that the Government would take ordinary shares in the Company to the extent of £500,000 out of £2,000,000; whereas they now do not propose to take any ordinary shares at all. The basis of the scheme laid before the meeting on Nov. 10, it was urged, was that the Government must be a considerable holder of ordinary shares. Another objection raised was that the dyers are being asked to bear too great a proportion of the burden in comparison with other traders who are equally interested—such as manufacturers, merchants, yarn spinners, &c. Further, the opinion was expressed that, before subscriptions were invited, full details of prices to be paid, and the basis on which they are to be paid, should be furnished in connection with the purchase of existing dye-ware manufactories.

The highly successful general meeting of the German Association of Gas and Water Engineers which was held in 1908 in Berlin resulted financially in a substantial surplus being left in the hands of the local Committee of Management, of which Herr Johannes Elster was the Chairman. By careful administration this surplus had grown to the sum of 11,500 marks (about £575), which the local Committee resolved, at a meeting held on the 27th of November last, to devote to war relief purposes. The sum is to be distributed as follows: The nominal amount of 5000 marks (£250) in 4 per cent. new Berlin debenture stock is to be made over to the Benevolent Fund of the German Association of Gas and Water Engineers for use only for the relief of necessitous members of the Association or their technical colleagues, and their widows or orphans, who shall need relief in consequence of the war. The remaining 6500 marks (£325) in new Berlin debenture stock is to be used as security at the official loan office for a loan of £250, which is to be applied forthwith solely for the benefit of Brandenburg militiamen who are fighting in the Eastern theatre of the war. A Committee, consisting of Herren Wellmann, Krause, and Elster, has been appointed to carry these resolutions into effect.

Mr. S. L. GLOVER, son of Mr. Thomas Glover, of Norwich, has received a Commission as Second Lieutenant in the Tenth Service Battalion of the West Riding Regiment, and last Wednesday took up his new duties at Aldershot. At the outbreak of war, he was engaged under his father at the Norwich Gas-Works; but he "answered the call" by leaving there to join the Public School Battalion attached to the Sixteenth Middlesex Regiment.

The Barry Urban District Council discussed, at a special meeting last week, the case of an unnaturalized German who had been employed at their gas-works. One of the members admitted that

he had put himself in communication with the military authorities, to get them to take the matter up; while another pointed out that the man in question had been in this country for nearly thirty years. The discussion, however, had no result; for the Chairman (Mr. S. R. Jones, J.P.) stated at the outset that the matter had already been dealt with by the police. Apparently, at the time of the Council meeting the German had left the district.

The 300 employees of the Richmond Gas Stove and Meter Company, Limited, who are serving in the Army (many of them now being with the Expeditionary force) have received a Christmas gift consisting of pipe, tobacco, cigarettes, and writing materials.

The Ventnor Gas and Water Company have been affected by the war, in the matter of loss of employees, to a remarkable extent. In fact, it is stated that no other company of this character in the United Kingdom have given so large a proportion of their staff to the national cause. During the first week in August all the men, with the exception of the foreman, had left the gas-works. Four outside men were then procured, and trained to the work; but within six weeks two of them enlisted. A clerk and one man in charge of the water-works have also joined the Colours; while another man has just left. At present the Company are working six men short. Out of four fitters, only one remains for this special work. A former stoker, named Ridges, was killed in action some days ago. Another, named Stevens, is interned in Holland with the Naval Brigade. One of the Directors is a prisoner of war in Germany. He was an officer in the Sherwood Foresters.

At last week's meeting of the Darwen Town Council, the question was raised of taking steps to secure the release of three German workmen from the concentration camp at Lancaster in order to enable the Munich carbonizing plant at the Darwen Gas-Works to be completed. At their previous meeting, the Council agreed to support the application for the release of the men; and, providing proper surety is given, the authorities have intimated that they are willing to do this. Public opinion in the town, however, is opposed to the men being re-employed at the gas-works; and as a result of this the whole question has had to be reconsidered. It was decided at last week's meeting that no action be taken for a period of three months, and that the matter should then be again considered.

The total number of Glasgow Gas Department employees now serving with the Colours is 330—from the gas-works 283, and from the City Chambers offices 47. The wages paid to these men by the Corporation total £186 10s. per week, which sum is arrived at in accordance with the decision of the Corporation Committee dealing with allowances to those serving their King and country. Vacancies have been temporarily filled; but all men who have enlisted will find their situations open for them on their return.

A correspondent writes to the "Daily Telegraph" calling attention to the increasing number of street fatalities held to be attributable to the darkened condition of the streets, despite the fact that the number of motor-omnibuses now in use has been considerably reduced owing to Government requisitions. Within the last few days, he says, nearly a dozen traffic fatalities have been inquired into at the City Coroner's Court; and in nearly all of these the darkened condition of the thoroughfares was found to have been an important factor. The writer urges all who have to use the streets after sunset, both pedestrians and drivers, to exercise extraordinary care.

"Transactions" of the Institution of Gas Engineers.

We have received the "Transactions" of the Institution of Gas Engineers for the past year. The volume contains a full report of the proceedings at the annual general meeting held in Liverpool in June last, under the presidency of Mr. Edward Allen, M.Inst.C.E., the Engineer of the Liverpool Gas Company. The papers, with the report of the discussions, have all appeared in the "JOURNAL." The contents include the reports of the Refractory Materials and Ventilation Research Committees of the Institution, as well as those submitted by Mr. Harold Hartley, M.Sc., Mr. Harold Hollings, B.Sc., and Professor J. W. Cobb under the Institution Gas Fellowship, with a report of the remarks to which they gave rise. The lecture, by Mr. Charles Carpenter, D.Sc., on "The Purification of Gas by Heat," is given; and there are abstracts of papers which appeared in various publications in the twelve months ended June, 1914. The other matter includes lists of the officers, council, committees, and members of the Institution, and the officers and committee of the Benevolent Fund; the names of the Advisory Committees on the Livesey Professorship and the Corbet Woodall Scholarship, and of the National Illumination Committee of Great Britain; and notices of the work of the members removed by death. The receptions and excursions are duly noticed. The volume, which, as usual, has for frontispiece a portrait of the President, has been produced under the editorship of Mr. Walter T. Dunn, the Secretary of the Institution.

ELECTRICITY SUPPLY MEMORANDA.

THOSE concerned in Metropolitan electricity supply have managed to create between them the promise of considerable liveliness this session for those portions of the legislative edifice set apart for Private Bill work. Perhaps it is a good thing—for our friends at Westminster, if for no one else; for in all other respects the session threatens to be as flat as ditch water. Whenever there is any serious talk about unifying the electricity supply conditions of the Metropolis, one may always be sure there will be a certain amount of life abroad, and one may be equally certain, if the proposals come under the review of Parliament, of meeting at Westminster everybody who is anybody in London electrical affairs. The London County Council came out with their big public-authority-company-and-advisory-committee controlled scheme for co-ordinating and consolidating piecemeal the electricity supply of the Administrative County of London and large parts of neighbouring counties. Then at the eleventh hour, ten of the most important companies supplying mostly the lucrative West-end areas appear in solid formation with a scheme by which they evidently hope to checkmate the County Council, and to throw things into such turmoil that there will be no immediate final decision. The appearance of these two Bills—one promoted by the County Council, the other by the ten companies—commit London irrevocably to the principle of consolidation in respect of electricity supply. The County Council say it is the one thing needful; the Companies in the preamble of their Bill admit that it is requisite. [Details of the Companies' Bill appear on p. 75.] Then the County Council have, by the very lines they have taken in their scheme, admitted the superiority in trading of company over municipal management, and to follow this admission to its logical conclusion, company management unadulterated by municipal meddlesomeness, must be still more superior. Therefore, the Companies can claim that the County Council action in providing for Company management supports them in appealing direct to Parliament. Then this move on the part of the Companies will have another effect, and that is in compelling the Council to go forward with their scheme whatever the nature of the opposition assailing it. At one time, either the Parliamentary or Finance Committee of the Council (we forget for the moment which) thought that, if the parliamentary situation became too hot for them, and the expense threatened to become too great, while the chances of success diminished, the Council could simply withdraw the Bill. This will now be impossible. The Council could never, of course, consent to withdraw their scheme, and leave a concrete project like that of the Companies in possession of the field.

Competing Schemes.

Favour and Disfavour.

If it were not that the area of supply mapped-out by the Companies is not coterminous with that of the London County Council scheme, it might well have been that the proposed new Company might have stepped in as the Company requisite to the County Council scheme. Perhaps even now it may be considered by Parliament that here is presented an open way out of a beautiful muddle. However, we shall see; for London and the critics are not yet in possession of all that there is at the backs of these two, on the face, hostile measures. Again, there is one thing that makes the Companies' scheme more acceptable than the inconclusive one of the County Council; and it is that the Companies propose prompt consolidation of important established interests, whereas there has been no report yet that the County Council have secured any important undertakings to supply them with a nucleus for their scheme. It is all optional whether or not any of the existing undertakings exercise the necessary generosity to give the Council a start. The electrical critics hardly know what to make out of the new situation. To the "Electrician," the Companies' scheme seems to be "a great advance" on any that has hitherto been made by the Companies. Our contemporary also regards it as "a reasonable proposition." "The scheme does not interfere unduly with the undertakings of the local authorities; and it would utilize to a large extent organizations already in existence." The "Electrician," therefore, we take it, accepts the scheme as preferable to that of the County Council. But a writer signing himself "Onlooker" in the "Electrical Review" has been raised to a state of high-temperature indignation over the effrontery of the Companies. He says that *primâ facie* it would certainly seem somewhat discreditable that London Companies who have had so many years in which to develop a scheme should now, at this juncture, bring forward "a partial and incomplete" one. He appears to think there is an air of insincerity over the whole thing, that the Companies concerned have no idea of developing electrical supply in the outside areas, and that the period of three years within which the new Company are to submit to the Board of Trade a scheme of supply which shall produce consolidation and uniformity is evidence that they want to get the powers into their hands, and then do as little as possible. He overlooks the fact that the extensive interests represented by the ten Companies are to be transferred and vested in the new Company on Jan. 1 next, and that it takes time to produce schemes of this order. The County Council do not, by their project, anticipate the attaining of consolidation

and uniformity in a day; and certain it is the Council cannot show such an extensive piece of consolidation as the Companies put on the table to take effect as from Jan. 1 next.

Sales Development Committee.

The members of the "Development Committee" of the Incorporated Municipal Electrical Association are hoping to live up to their title. The Committee is a growth from a suggestion made in the voluminous paper read by Mr. W. A. Vignoles, of Grimsby, at the last meeting of the Association. As a reward for his idea, the Council have appointed Mr. Vignoles, Honorary Secretary of the Committee; while Mr. S. E. Fedden, of Sheffield, has been elected Chairman. It is recognized that the work of the Committee will be less valuable if entirely municipally directed; and therefore it has been decided to leaven municipal thought and action by co-opting, if possible, members representing the various other organizations connected with the supply of electricity and allied interests. Certain electricity supplying gas undertakings are in existence; but there there is no information as to whether their presence on the Committee will be invited. It has also been decided to form, as soon as practicable, sub-committees to deal in a specialized manner with various questions of interest at the present moment. A further adopted proposal is to appoint technical sub-committees, with the object of investigating problems of interest which might arise during the year. The Committee are going to hold another meeting shortly; and as reports are to be sent to the Press, there will be an opportunity of following, as closely as we are permitted to do, the activities of the new sprout from the Municipal Association.

Through Rose-Coloured Glasses.

Our dear old friend the "Electrical Review" has taken to wearing rose-coloured glasses. It has been reviewing the electrical events of 1914, and incidentally refers to cooking and heating. It tells its readers that "all the technical advances" made in apparatus "are still insufficient to account for the extraordinary development in the popular appreciation of, and demand for, electrical cooking and heating." Really this is indeed very interesting. We had not seen such an "extraordinary development," nor have the "Point-Fives." Although the omniscient "Review" submits that the technical advances are sufficient to account for something that is hidden from most folks, it fails to enlighten its readers as to the actual cause of the extraordinary development. The "Review" is prudent on this occasion. Then what must be a *lapsus calami* follows. "Where energy," it is written, "is to be had for 1d. a unit or less," the success of electrical cooking, and "its ability to compete with gas cooking, are well established." Are they? Of course, it follows that if 1d. per unit can compete with gas cooking, then the words "or less" need not have intruded themselves into the statement, and the "Point-Fives" must confess themselves a redundant institution. Mr. Seabrook has said that the competitive price is ½d., and not 1d., and the "Point-Fives" state that experience demonstrates that the ½d. is insufficient without more reliable and cheaper domestic appliances, and appliances that will not cost much to maintain, and will not occasion annoyance by reprehensible conduct. But the gas industry knows from experience that householders have found that the electric-cooker is not for over-all culinary operations an effective competitor of the long-range gas-cooker. However, we forgive the "Review," because: "No one attempts to maintain that electrical heating, under ordinary conditions, is economical in comparison with gas or coal heating as regards the actual cost of fuel or energy; and therefore, in order to account for the remarkable demand for electric radiators which has been observed during the year, it is necessary to assume that the advantages inherent and peculiar to electric heating—such as portability of the radiator, perfect cleanliness, freedom from fumes and fire risk, and ease of control—far outweigh the consideration of running cost." "Freedom from fumes and fire risk!" Modern gas-fires are also free from escaping fumes; and as to the "fire risk"—may the elastic conscience of the "Review" be disturbed, and have its ways mended.

Hazy Information.

In a note with this sub-heading on Dec. 23, 1913, there was a little destructive criticism of certain statements that appeared in "Hazell's Annual" for 1914, a copy of which was sent to us for review. The statements in question concerned electric cooking, and its ultimate universal destiny; and they were based on the shallowest of assumption. Apparently this action on our part was not acceptable to those responsible for the contents of the "Annual;" for this year a copy has not been forwarded to us for review. If the criticism be the reason for the omission, then the action savours of juvenility. It can hardly be the effect of criticism, however, because the Editor, in the preface to the volume for 1915 [a copy of which we have purchased], expresses his gratification at the interest taken in the pages of the "Annual" during the past year; and he returns thanks for the "valuable suggestions" which from time to time have been conveyed to him. We are bold enough to believe that our criticism constituted a "valuable suggestion," because it is found that the senseless passages referring to electric cooking have been eliminated. A fair amount of space in the current volume has been devoted to electrical affairs, more so than to those of the older and influential gas-supply industry, which is disposed of by an allusion to its co-partnership schemes, and less than half-a-dozen lines upon its central Institution. A large amount of attention is devoted to the interests of the electrical industry in relation to the war. It is averred that the industry has not suffered to the extent that might have been expected; but it is admitted that the demand for some classes of electrical apparatus which "may be regarded more or less as luxuries" has fallen off. There is a different tone in this from that which obtained the year before. It is further shown how deeply indebted Germany must be to the electrical industry, for its industrious friendly patronage of its plant and other manufactures. The so-called "half-watt" lamp is pointed to as an event of the year. "As its name implies," says the writer of the chapter, "the lamp has an efficiency of half a watt per candle, or, to put it more correctly, 2 candles per watt." If the Editor of the "Annual" really knew the facts of the matter, he would have amended his contributor's statement by saying that the title of the lamp is a misnomer, and that the actual efficiency is nearer 1 candle per 0·75 watt than the nominal figure. Again the reader is told that "electric cooking continues to make rapid strides, and some large installations have been put down during the year, while many hundreds of domestic equipments have been added to the list." Although the writer of the "Memoranda" keeps close observation upon the electric supply business, he has failed to detect the "rapid strides;" and when "hundreds of domestic equipments" are spoken of, he smiles as he thinks in millions of gas-cooking equipments in the United Kingdom. Yet Mr. Editor of "Hazell's Annual" does not seem to be disposed to find space for data as to the actual position of the gas industry. If some of those electrical engineers who are supplying at 0·5d. per unit of electricity for cooking and heating to the disadvantage of the lighting consumers, or at 0·5d. *plus* a fixed charge on the rateable value, spoke the truth into the ears of the Editor of the "Annual," he would be surprised at the little actual headway most of them have made with the electric-cooker. Several of them could also, were they so disposed, tell of the supremacy again of the gas-cooker in certain kitchens where for a time the electric cooker struggled to reign.

Metalite Limited.

"Limited" indeed was the Metalite Company in more ways than one. It will be remembered with what insane brag the Company was launched a few years ago, when flaming advertisements and prospectus appeared foreshadowing golden prospects with a lamp that was to knock out of any possible competition the economy and efficiency of the newest inverted gas-burners. The statements were criticized and challenged in these columns; but never a word in reply from those responsible for the tissue of absurdity and extravagance that constituted the advertisements and prospectus statements. The sound of the big drum died away; the bluster ceased; and a hopeless struggle for existence began, which ended in the closing of the lamp works, and gave employment to a liquidator. Now there is to be a reconstruction; and the prospectus has been issued of the Derby Lamp Works, Limited. In this concern, the old disappointed Metalite dupes are to have the privilege of paying up so much per share, to make a fresh start in life in the electric-lamp trade. In the prospectus, more caution is displayed than when that of the original Company was issued. But there is an attempt to make the mouths water of Metalite shareholders by the subtle statement that "a dividend of 22 per cent. per annum on the preference and 15 per cent. per annum on the ordinary, shares would, if the whole capital were issued and fully paid, amount to £13,905." The question in which the shareholders are naturally most interested is not as to the sum required to pay these dividends, but whether the sum can be earned. What are the chances? The Chairman of the new Company states that there is now a monopoly in this country for British electric-lamp makers, while the outside commercial doors of Germany are locked. This "monopoly" has not a far-reaching intrinsic value, as the war is not going to last for ever; and the German makers will be over here with a rush as soon as the terms of peace are signed. Then another consideration is that the Directors of the new Company are hoping to produce and market a wire-drawn lamp at a price cheaper than that now ruling with the Tungsten Lamp Association, to which Association we surmise the Chairman was referring when (at a meeting of the shareholders) he spoke of a "ring." But surely the existing lamp makers are not going to sit lifeless while the Derby Works, Limited, cut big lumps out of their businesses. And a point for those who are proposing to invest money in the new venture is as to whether the wire-drawn lamp which it is intended to make at the Derby works rides high and dry above the waters of litigation. There has of late been quite a flood of electric-lamp litigation.

Workmen's Compensation Cases.—We have recently received from Messrs. Butterworth and Co., of Bell Yard, Temple Bar, Vol. VII. of "Butterworth's Workmen's Compensation Cases" (New Series). It is a continuation of Minton-Senhouse's work bearing a similar title, and deals with cases decided in the period from October, 1913, to October, 1914. The book is edited by his Honour Judge Ruegg, K.C., and Mr. Douglas Knocker, assisted by Mr. Edgar T. Dale. The price is 12s. 6d. net. A notice of the contents of the volume is in preparation.

GAS BILLS FOR 1915.

HAVING in a single article disposed of the Bills of the few statutory gas companies who are in Parliament this session, we may now turn to the local authority promotions in which gas monopolizes the measures or merely forms part of them.

Incorporated in the Act of the Chelmsford Gas Company of last session was an agreement for the transfer of the undertaking to the Corporation, providing an empowering Bill was introduced this session. The draft Bill lodged by the Corporation provides for notice of purchase being given to the Company within six months after the passing of the Act—the price to be paid being either by agreement or arbitration. In addition, the Corporation are to pay the Company the costs incurred in obtaining their Act last session, the expenses involved in watching and procuring any amendment in the present Bill, and £200 in respect of the transfer of the undertaking and the winding-up of the Company. Provision is also made for the payment of all dividends due up to the time of transfer. A compensation clause appears referring to Directors, officers, and servants (of not less than ten years' standing) who are not retained in the employ of the Corporation. The repeal is sought of certain clauses of the Company's Act of 1914, and the retention by the Corporation of the remainder. The defined limits of supply are those specified in the Company's Act; and in this connection the right is conferred upon outside authorities to purchase any part of the undertaking within their administrative jurisdiction. The maximum price proposed for gas supplied through ordinary meters is, within Chelmsford and the parishes of Springfield, Broomfield, and Great Baddow 3s. 9d.; and beyond the charge is not to exceed by more than 9d. the price within the borough and the parishes just specified. The Corporation are asking for an illuminating power test, with a standard of 14 candles. In the financial clauses, power is sought to borrow the sums necessary for the purchase of the concern, for compensations, and for the expenses attendant upon the winding-up of the Company, as well as, for the extension and improvement of the undertaking, any sums not exceeding in the whole £60,000, and, in addition, the amount required for defraying the costs of the present measure. The desired repayment period for the purchase money and loans raised for the extension and improvement of the undertaking is 35 years. Regarding the revenue, after paying all the expenses and charges connected with the carrying on of the undertaking, and providing a reserve fund, one moiety of the balance is to be transferred to the district fund, and the other moiety is to be carried to the revenue account for the next succeeding year, and, when there is sufficient accumulation, it is to be applied to the reduction of the price of gas. [*Parliamentary Agents: Messrs. Hargreaves and Crowthers.*]

The Dewsbury Corporation are desirous of extending their area of supply to the urban districts of Emley, Flockton, and Whitley Upper. The calorific value standard is proposed at 540 B.Th.U. (total heat value test); all the conditions being on the lines of the model clauses. Provision is made for the repeal of the illuminating power standard and test. A clause appears enacting that nothing in the section is to exempt the Corporation or their gas undertaking from the provisions of any General Act relating to the supply of gas which may be passed in this or any future session of Parliament. The Corporation take power to enter into agreements for the purchase of gas in a crude or partially purified state. In another part of the Bill, power is taken to attach brackets, wires, and apparatus to buildings for the purpose of street lighting by either gas or electricity. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Doncaster Corporation wish to extend their limits of supply so as to include the parishes of Barnby-Dun Cadeby, High Melton, and Edlington. A piece of land, of upwards of 5 acres in extent, and adjoining the present works, is scheduled for gas-works purposes. The eviction of the illuminating power standard, and the setting-up in all details of the model calorific clauses, are the subjects of further provision, as are also stand-by supplies. The Corporation also take power to purchase gas in bulk in a crude or partially purified state. Among the financial provisions, the promoters ask for power to borrow £65,000 for the acquisition of the additional gas-works land and the construction of new works, with forty years as the period for repayment. Clauses are included having for their purpose the regulation of the sale of coke. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

In an Omnibus Bill the Lincoln Corporation are promoting, power is sought to extend the limits of gas supply to the parishes of Bracebridge Heath, North Hykeham, and Waddington. Later in the Bill, there are clauses providing for officers' superannuation and for regulating the sale of coke by hawkers. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Lurgan District Council, having agreed with the Lurgan Gas Light and Chemical Company, Limited, for the purchase and transfer of their property, are approaching Parliament for the necessary authorization. Turning first to the schedule containing the agreement, it is seen that the consideration for the sale is to be the payment by the Council to the Company of £40,000, and a sum equal to the actual expenditure on capital account properly incurred by the Company from the date of agreement to that of transfer (exclusive of two new exhausters and engines which the Company have agreed to purchase for £290), together with the value of the stores. By the clauses, the agreement is confirmed. Then follow all the provisions necessary to the transfer and the maintenance of the undertaking. The limits of supply are defined as including the urban district of Lurgan and several townlands in the counties of Armagh and Down. Correctly the Council, in their general powers clause, claim the right (in accordance with the finding of the Joint Committee) to "purchase, manufacture, convert, sell, and deal in all residual products resulting from the manufacture of gas." The maximum price of gas is placed at 4s. 3d. per 1000 cubic feet, with power to vary the charges according to the purpose for which the gas is to be used, "provided that the Council shall not, under the powers of this section give any preferential price as between any consumers who shall take a supply of gas for the same purpose under like circumstances." Calorific standard and testing are provided for—the standard suggested being 500 B.Th.U. (total heat test), without a margin. The remaining gas clauses (which include a stand-by one) are of ordinary character. The Council desire power to borrow the necessary sums payable to the Company, and up to £5000 for the extension and improvement of the undertaking, with a repayment period in both instances of forty years. For working capital up to £2000 is asked (repayment period, ten years), as well as the sum requisite for paying the costs of the Act (repayment period, five years). [*Parliamentary Agents: Messrs. Lees and Co.*]

The Plymouth Corporation have lodged a voluminous Bill referring to all sorts of matters affecting the government of the borough. Incorporated are a few clauses concerning the gas-works of the Corporation within the Devonport area. One provides for the continued vesting of the undertaking in the Corporation. Another empowers the maintenance, enlarging, &c., of the gas-works; and in the same clause the Corporation take power to "manufacture, purchase, sell, supply, and deal in" residual products, in compliance with the findings of the Joint Committee. The Bill provides for the illuminating power standard of 14 candles; and the maximum price of gas is placed at 4s. per 1000 cubic feet. Ordinary supply-in-bulk powers are sought, as well as authorization for bulk supply to Government establishments, in which case the price is to be that charged to private consumers for lighting purposes less a discount of 15 per cent. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

In a General Powers Bill, the Rhondda District Council include a stand-hy clause relating to gas, and another conferring upon them power to enter premises and remove gas-fittings. Among the miscellaneous clauses is one sanctioning contributions to funds of associations of local authorities or of their officers formed for the purpose of consultation as to their common interests and the discussion of matters relating to local government, together with the defraying of reasonable expenses incurred by attendance at conferences, and the costs of purchasing reports, &c. [*Parliamentary Agents: Messrs. Torr, Durnford, and Co.*]

Under the terms and conditions set forth in the Skegness Gas Company's Act of last session, the District Council are this session promoting an Act for the transfer and vesting in them of the Company's undertaking. The proposed limits of supply are the urban district of Skegness and the parishes of Croft and Winthorpe. The price to be paid for the undertaking is to be settled by agreement or arbitration, and notice of purchase is to be given within six months after the passing of the Act. The taxed costs and expenses of, and incident to, the transfer and winding-up of the Company (not exceeding £100) are to be paid by the Council. The necessary powers are taken for the maintenance and conduct of the concern. The Council contemplate powers to "manufacture, sell, provide, supply, and deal in" residual products, but they then proceed to limit themselves by the italicized words in the following: "resulting from the manufacture *by them* of gas." The illuminating power test, with a 14-candle standard, is provided for, with a maximum price of 3s. 6d., while for public lighting the price is not to be less than that charged to private consumers by more than 10 per cent. A stand-by clause in connection with the use of suction gas plant is inserted; and then we come to the financial clauses. The Council desire power to borrow the sum necessary for the purchase of the works, with a repayment period of forty years; a sum of £5000 for mains and other distribution works, with a repayment period of thirty years; and a sum of £1000 for working capital, as well as the requisite amount for defraying the costs of the Act. For the last two items a repayment period of five years is desired. [*Parliamentary Agents: Messrs. Baker and Sons.*]

The Bill of which the Smethwick Corporation gave notice has been withdrawn.

In connection with the Bill lodged by the Sunderland Corporation for the purpose of reconstructing Wearmouth Bridge, a clause appears affecting the gas and water pipes. The Corporation desire that the cost of any alteration, diversion, or stopping-up of any main, or of providing a substitute therefor, shall be repaid to them by the owner. It is further proposed that, if the Corporation afford accommodation for supporting pipes at the side of the bridge, the owners of the pipes are not to break open, or interfere with, the roadway or footpaths. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The late Mr. W. B. Bryan, the Chief Engineer of the Metropolitan Water Board, whose sudden death was recorded in the "JOURNAL" for the 3rd of November last, left estate of the gross value of £49,873.

ELECTRICITY SUPPLY BILLS.

THERE are two Electricity Supply Bills in which the Metropolitan and Suburban Gas Companies, and even other gas suppliers farther afield in the counties adjoining Middlesex, will be highly interested, seeing that they are indicative of fresh conditions under which competition will have to be carried on in future. Yorkshire gas undertakings will also be concerned in the Bill that the Electric Power Company are introducing partly for the purpose of giving them the right to supply current for lighting purposes in districts within their supply territory in which there are no authorized distributors. The Company are at present under strict limitations in this respect.

The first in importance is the Bill of the London County Council, in which it is proposed to take the preliminary steps to carry out a large project for co-ordinating and consolidating the electricity supply of London. From the notices that have already been given in the "JOURNAL" (particularly the one that appeared on Dec. 22, p. 684), it will have been gathered that the Council are proposing the creation of a public authority for electrical purposes in London and a considerable area around, and a Company for working the consolidated undertaking, with an advisory Committee.

But there appears to be a competing scheme in a more finished form, by which it is proposed to constitute another large Company, also with power to supply electrical energy in the Administrative County of London and the adjacent districts. It is submitted in the preamble of the Bill that the system under which a number of companies and local authorities have rights of electricity supply in the administrative county and adjacent areas is unfavourable to the supply of electrical energy under the best economic conditions. It is further submitted that electrical energy can be supplied more effectively and economically from one combined undertaking than by means of a number of smaller and separate undertakings. Among the first proprietors of the new Company are Messrs. W. F. Fladgate, H. R. Beeton, E. Ironside Bax, W. R. Davies, R. Evelyn Crompton, R. Stewart Bain, W. H. Cripps, Arthur E. Franklin, Walter Leaf, and Joseph Browne-Martin. These are to be the first Directors of the Company, the name of which is to be the "London Electric Supply Company." The number of Directors is to be not less than six nor more than fifteen; and the qualification of Directors is to be not less than £1000 of ordinary stock. From Jan. 1 next, it is proposed that there shall be transferred to, and vested in, the Company, upon agreed or upon arbitration terms, the following undertakings: The Charing Cross (West-end and City) Electricity Supply Company, Limited, the Brompton and Kensington Electricity Supply Company, Limited, the Central Electric Supply Company, Limited, the Chelsea Electric Supply Company, Limited, the Kensington and Knightsbridge Electric Lighting Company, Limited, the London Electric Supply Corporation, Limited, the Metropolitan Electric Supply Company, Limited, the Notting Hill Electric Lighting Company, Limited, the St. James' and Pall Mall Electric Light Company, Limited, and the Westminster Electric Supply Corporation, Limited. Due provision is made for the Company at their option, in lieu of making payment in money, to issue to the Liquidator of the transferred company either securities or stocks of the new undertaking. Provision is made for the compensation of Directors and officers. The area of supply is defined as follows: The Administrative County of London. The Borough of Ealing, and the urban districts of Acton, Hanwell, Southall-Norwood, Greenford, Uxbridge, Hayes, Chiswick, Brentford, Heston and Isleworth, Twickenham, Teddington, Hampton, Hampton Wick, Ruislip-Northwood, Sunbury-on-Thames, Feltham, and Staines, and the rural districts of Uxbridge and Staines, all in the County of Middlesex. The urban district of Rickmansworth and the parishes of Rickmansworth rural and Chorley Wood, all in the County of Hertford. The urban districts of Beaconsfield, Eton, and Slough, the rural district of Eton, so much of the rural district of Amersham as lies to the southward of the main roads leading from Little Missenden through Chesham to Chenies, and so much of the rural district of Wycombe as lies to the eastward of the main road leading from Amersham through Chepping Wycombe to Marlow Bridge, all in the County of Buckingham. The borough of New Windsor and the rural district of Windsor, both in the County of Berkshire. The urban district of Chertsey, the rural district of Egham, the parish of Thorpe in the rural district of Chertsey, and the parishes of Addington, Beddington, Couldsdon, Mitcham, Morden, Sanderstead, and Woodmansterne, in the rural district of Croydon, all in the County of Surrey. The urban districts of Romford and Tilbury, and the rural districts of Orsett and Romford, all in the County of Essex. The urban district of Penge in the County of Kent. Electrical energy is not to be supplied by the Company otherwise than in the transferred areas, in bulk to authorized distributors, and at any point in the area of supply to any company, body, or person, owning or working any railway, tramway, canal, navigation, dock, or water-works. If the Company make default in supplying energy to any authorized distributors, it is proposed that they shall be liable in respect of each default to a penalty not exceeding £10 for each day on which the default occurs, provided that the penalties inflicted on the Company shall not exceed in respect of any one default, not being wilful, the sum of £500. Penalties are not to be inflicted if, in the opinion of the Court, the default was caused by inevitable accident or *force majeure*, or was of so slight and unimportant a character as not to affect the value of the supply. Within three years, the Company propose to submit to the Board of Trade a scheme for securing the consolidation of, and uniformity in, the system and mode of generation and supply of electrical energy throughout the area of supply. It is proposed that no existing suppliers shall extend any generating station or instal any new plant without the consent of the Board of Trade; and, in determining the matter, the Board are to have regard to the price at which the new Company are prepared to afford a supply. The proposed capital of the Company is 6 millions, of which 2 millions may issue as preference stock, entitled to a dividend not exceeding 6 per cent. per annum. Borrowing powers are also desired up to one-third part. In another provision, it is proposed that the London County Council, or any authority established for the ultimate acquisition of the system of supply of electrical energy in the County of London, may contribute to the capital of the Company. The ordinary stock is to be entitled to a dividend of 8 per cent. But when the surplus divisible profit exceeds an amount equal to 4 per cent. on the ordinary stock, it is proposed that it shall be applied as to three-fourths in giving to the consumers a rateable rebate on the amounts paid by them for the preceding year, and the remaining one-fourth may be distributed among the holders of the ordinary stock, notwithstanding that the dividend is thereby increased beyond the rate of 8 per cent. A sinking fund, special purposes fund, and reserve fund are provided for. Other clauses contemplate the possibility of agreements with the County Council or other public authority for taking over the concern, and with local authorities and others for the acquiring of their electricity undertakings. [*Parliamentary Agents: Messrs. Dyson and Co.*]

Under their Act of 1901, the Yorkshire Electric Power Company obtained capital authorization to the amount of 2 million pounds. They have created and issued 27,164 ordinary shares of £10 each and 37,232 cumulative preference shares of £5 each, and have borrowed and now owe £70,000. Altogether, the Company have expended on capital account upwards of £523,000. It is now desired that the capital shall be divided into shares of £1 each. The Company also wish to be empowered to supply persons (other than authorized undertakers) wanting a supply for lighting purposes in districts within their area not in possession of a service. [*Parliamentary Agents: Messrs. Dyson and Co.*]

COAL STATISTICS FOR 1913.

A Heavy Increase in Output.

ON seeking to compare the statistics of output and prices of coal for the year 1913 with those of the preceding twelve months, one is immediately reminded of the fact that 1912 was the year of the great coal strike, when practically the whole of the mines of the United Kingdom were idle for a period of six weeks or so. The influence of this factor upon the figures is, indeed, emphasized by Mr. R. A. S. Redmayne, the Chief Inspector of Mines, in the course of the opening remarks to his report which contains the information referred to for the year ended December, 1913—that is, Part III. of the Annual Home Office Report on Mines and Quarries, which was last week issued as a Blue-Book. Coal is, of course, not by any means the only mineral dealt with in the report, but from the point of view of both quantity and value it is by far the most important.

It is seen from the report that the total quantity of coal raised during 1913 was 287,430,473 tons, of a value at the mines and quarries of £145,535,669. The figures for the year 1912 were 260,416,338 tons, value £117,921,123; for 1911, 271,891,899 tons, value £110,783,682; for 1910, 264,433,028 tons, value £108,377,567; for 1909, 263,774,312 tons, value £106,274,900; for 1908, 261,528,795 tons, value £116,598,848. Thus there was an increase in 1913, compared with 1912 (the year of the strike), in the output of 27,014,135 tons, and in the value of £27,614,546. The average price of coal at the pit was 10s. 1·52d. per ton in 1913; while the figure for 1912 was 9s. 0·68d. The value of the coal at the mines for each of the preceding four years was: In 1911, 8s. 1·79d.; 1910, 8s. 2·36d.; 1909, 8s. 0·7d.; and 1908, 8s. 11d. It will be noticed from these figures that in not one of the years named did the average price per ton come within 1s. of that ruling for 1913.

The increase in output during the year under review was shared by England, Wales, and Scotland—Ireland alone exhibiting some falling off as compared with the preceding twelve months. Actually, the increase in the case of England was 19,097,437 tons, Wales 4,986,597 tons, and Scotland 2,937,887 tons; the decrease for Ireland being 7786 tons. The complete figures for 1913 were: England, 199,929,568 tons, of a total value of £98,510,746; Wales, 44,961,868 tons, value £26,459,396; Scotland, 42,456,516 tons, value £20,514,873; and Ireland, 82,521 tons, value £50,654. The total output of anthracite (which is included in the statistics relating to coal) for the twelve months now being reviewed was 5,194,620 tons, which was valued at £3,089,847. There is some increase in the figures compared with 1912, when the output was 4,695,691 tons, and the value £2,689,167. Wales is, of course,

responsible for all but a very small proportion of the anthracite raised.

At the pit's mouth in the different fields, in 1913, the prices of coal were as follows: In the Scotch coalfields, 9s. 7·97d. per ton; in the Northern coalfield, 10s. 5·88d.; in the Yorkshire, &c., coalfield, 9s. 1·91d.; in the Lancashire and Cheshire field, 10s. 2·62d.; in the Midland coalfields, 8s. 10·37d.; in small detached coalfields, 10s. 1·67d.; in the North Wales coalfield, 9s. 11·74d.; in the South Wales coalfield, 11s. 10·51d.; and in the Irish coalfields, 12s. 3·32d. per ton. The average price per ton at the pit's mouth was for England 9s. 10·25d., and for Wales 11s. 9·24d.; the average over the whole of the fields working out, as already stated, at 10s. 1·52d. The average price in the London market was 21s. per ton in 1913, compared with 20s. 11d. per ton in 1912, 17s. in 1911, 16s. 3d. in 1910, and 16s. 11d. in 1909.

As to exports, it is found from the report that the quantity of coal which left the country in 1913 (exclusive of coke and patent fuel, and of coal shipped by steamers engaged in foreign trade) was 73,400,118 tons, compared with 64,444,395 tons in the preceding year—or an increase of about 9,000,000 tons. In 1911, the exports were 64,599,266 tons; and in 1910, 62,085,476 tons. The declared value of the 1913 exports of coal was £50,727,252, and of those of the preceding year £40,494,274. There was also, in the twelve months now being dealt with, in addition to the quantity just named, the equivalent of 2,058,568 tons of coal exported in the shape of 1,235,141 tons of coke and the equivalent of 1,847,868 tons of coal in the form of 2,053,187 tons of manufactured fuel. Adding to this the 21,031,550 tons of coal shipped for the use of steamers engaged in foreign trade, there was a total quantity of coal and coal equivalent shipped of 98,338,104 tons, compared with 85,842,905 tons in 1912. The declared value of the exports of coke was £1,149,822, and of manufactured fuel £1,782,586.

One of the tables in the report gives the countries to which the coal and coal equivalents were exported; and this shows that once more the three largest customers were France, Italy, and Germany—in the order named. The quantity which was taken by France in 1913 was 13,033,984 tons, the declared value of which was £8,291,958; the amount taken by Italy was 9,966,557 tons, value £7,159,415; Germany took 8,973,990 tons, value £5,345,732. For the year 1912 the quantities exported to these three countries were: France, 10,359,375 tons; Italy, 9,450,852 tons; Germany, 8,400,023 tons. Turning now for a moment to imports, it is noticed that the quantity of coal, coke, and manufactured fuel brought into the United Kingdom fell from the not very extensive figure of 191,768 tons in 1912, to the utterly insignificant total of 24,029 tons in 1913; the value being £36,700, against £276,516. Practically the whole of the amount came from the Netherlands (10,302 tons), Germany (7897 tons), and the United States (5204 tons). Of the 287,430,473 tons of coal raised, the quantity remaining for home consumption for all purposes, after meeting all the requirements from abroad, was 189,092,369 tons; and reckoning the population of the United Kingdom at 46,032,115, this amount represents 4·108 tons per head—a quantity which has been exceeded on only one occasion (and then by very little) during the forty years over which the statistics extend. In 1912, the quantity which remained for home consumption was equal to 3·823 tons per head of the population.

The Production of Coke.

In one of the sections of the report, coke is dealt with on similar lines to preceding years. Particulars are furnished with regard to the production of coke and briquettes, and the number of coking-ovens in use. For the year 1913, returns of the production of coke were received from 159 colliery owners (comprising 231 separate works), 1464 gas companies, and 18 other owners of coke-ovens. As was the case twelve months earlier, the counties of Durham and York provided 65 per cent. of the total quantity of coke made in coking-ovens; 67 per cent. of the total number of ovens being worked in these counties. Of the 234 works, other than gas-works, where coking plant is in use, bye-products—chiefly sulphate of ammonia and tar—were, in the year under review, recovered at 88. This figure is one less than the previous year, but compares with 81 works in 1911. As to information about briquettes, returns were obtained from all firms known to be engaged in their manufacture out of very fine slack which would otherwise be of small commercial value.

The total quantity of coal used in the manufacture of coke in 1913 is put at 37,483,944 tons; the amount of coke obtained being 20,529,732 tons (7,830,736 tons from gas-works, and 12,798,996 tons from coke-ovens), of a value of £17,456,461. In 1912, there was an output of 7,629,716 tons from gas-works, and 10,720,352 tons from coke-ovens; the total being 18,350,068 tons. Of the output from gas-works in 1913, 6,813,963 tons came from England, 157,583 tons from Wales, 673,401 tons from Scotland, 175,488 tons from Ireland, and 10,301 tons from the Isle of Man. There were 21,006 coke-ovens in use; and of these 13,167 were of the beehive pattern. Of the rest, the four types most largely in use were the Coppée, the Otto-Hilgenstock, the Simon-Carvés, the Semet-Solvay, and the Koppers. There were 2,213,205 tons of briquettes produced, of a value at the place of manufacture of £1,895,847.

Other Minerals.

Beyond coal and coke, there is not a great deal in the Blue-Book which calls for mention here. The amount of bog ore obtained from open workings in Ireland during 1913 was 3835 tons, of a value at the workings of £959. These figures compare with 3340 tons, of a value of £835, the preceding year. During the year under review, the output of iron ore was 15,997,328 tons, of a value of £4,543,558. This was 2,206,937 tons more than in 1912. The supporters of the Heathfield natural gas proposition will derive from the present report small material for argument in favour of the scheme. During 1913 the amount of natural gas obtained at this place was 87,450 cubic feet, against 161,200 cubic feet the year before. In fact, for several years the output has been a diminishing quantity. The amount of gas obtained in 1911 was 221,400 feet; and in 1910, it was 262,000 feet. The output of oil shale from mines and quarries in the United Kingdom in 1913 was 3,280,143 tons. The average price per ton at the mines was 5s. 0·17d.; the total value being £822,394. The figures for 1912 were 3,184,826 tons, value £765,730. The average yield of oil is put at 22 gallons per ton of shale, and of sulphate of ammonia at 45 lbs.

Imports of Petroleum.

As has been the case for several years past, no petroleum was obtained in Great Britain in 1913; but the quantity imported amounted to no less than 488,106,963 gallons, the value of which was £10,856,806. This compares with 413,333,358 gallons, of a value of £7,341,689, in 1912. The principal sources of supply were: United States, 303,649,141 gallons; Roumania, 57,365,437 gallons; Russia, 38,290,958 gallons. Compared with the previous year, the increase in the imports from the United States is more than the total amount brought in from Russia. The relative importance of the trade to the three countries named is shown by the following figures of value of the imports in the year under review: United States, £5,867,928; Russia, £1,027,811 Roumania, £955,267.

THE GAS CHEMISTS' HANDBOOK.

(*Concluded from p.* 29.)

Impurities.

For total sulphur in gas the Referees' apparatus is recommended, on account of its wide use and ease of manipulation; an observation being made as to the precaution of replenishing the supply of ammonium carbonate after 3 cubic feet of gas have been burned. The barium sulphate is precipitated from nearly neutral solution obtained by adding hydrochloric acid (1 : 1), with methyl orange or paranitrophenol indicator, to neutrality, and then making the solution faintly acid by the addition of a further 2 c.c. of the acid. After precipitation from the boiling solution with 10 per cent. barium chloride solution, the barium sulphate is washed with hot water until the filtrate amounts to 200 c.c. It being assumed, we take it, that, under these conditions, the precipitate is free from chloride.

For the estimation of sulphuretted hydrogen, a special burette is used, provided top and bottom with a three-way cock, communicating at the top through one of the outlets with a 10 c.c. glass stoppered cylinder graduated into 0·1 c.c. There are only two graduations on the burette proper—one at the 100 c.c. mark, the other 50 m.m. from the bottom cock, dividing the remaining space into two divisions of about 5 c.c. and 10 c.c. respectively. The solutions required are standard iodine and starch, and 1 c.c. of the former contains 0·0017076 gramme of iodine and is equivalent to 100 grains of sulphuretted hydrogen per 100 cubic feet.

In making a test, the burette is filled with the starch solution and run out through the gas inlet tube. Gas is then admitted until the starch solution passes the 100 c.c. mark on the burette stem. By means of a levelling tube, the gas is brought to the 100 c.c. mark; the top tap being then opened so as to bring the volume to atmospheric pressure. After closing the top cock, the lower one is opened, and, lowering the levelling tube, the starch is drawn out of the burette down to the 10 c.c. mark. A definite quantity of the iodine solution is next added to the graduated cylinder and then allowed to gradually enter the burette, shaking well between each addition, until the starch assumes a faint, but permanent, blue colour. The iodine remaining in the cylinder subtracted from the original amount taken, multiplied by 100, gives (directly) the number of grains of sulphuretted hydrogen per 100 cubic feet of gas.

Gas Oil.

This is sampled as described for ammoniacal liquor (*loc. cit.*). The specific gravity is taken by the hydrometer and corrected to 15·5° C., using the factor 0·009. For determining the specific gravity of the fractions, the Sprengel tube is recommended; but it may perhaps be suggested that a small specific gravity bottle is much easier to manipulate. It is suggested that, as the American Society for Testing Materials have very generally used 25° C. as the normal temperature, this figure should be adopted. A determination of refractive index at 25° C. instead of specific gravity is recommended as giving really more information and requiring but a fraction of the time to determine.

For the "bromine number," 0·3 to 0·5 gramme of oil is weighed into an 8-ounce stoppered bottle, 10 c.c. of bromine solution is run in, the bottle stoppered, and well shaken. After cooling in ice water, 25 c.c. of 10 per cent. potassium iodide solution is added, with shaking—taking care to prevent any of the solution getting

on, or near to, the stopper—and then titrated with N/10 sodium thiosulphate, using starch as indicator. The reaction is—

$$Br_2 + 2KI = 2KBr + I_2$$
$$I_2 + 2Na_2S_2O_3 = 2NaI + Na_2S_4O_6$$

The cubic centimetres of bromine, multiplied by the equivalent to thiosulphate, equals the equivalent volume of thiosulphate. The latter, *minus* the thiosulphate used in titration, gives the cubic centimetres used; and the cubic centimetres of thiosulphate used multiplied by 0·008 gives the grammes of bromine absorbed; this being then calculated to percentage absorbed by the oil.

The bromine is made up with dry carbon tetrachloride, and approximately of such strength that 1 c.c. should equal 1·5 c.c. of thiosulphate solution (24·8 grammes per litre). The flask for the distillation should be a 100 c.c Engler, having the following dimensions:

Diameter of bulb	6·5 cm.
Length of neck	15·0 ,,
Diameter ,,	1·6 ,,
Surface of oil to tubulure	9 0 ,,
Length of tubulure	10·0 ,,
Angle of ,,	75 degrees

A 3 per cent. variation from the above is allowable.

The thermometer is to be a high temperature nitrogen filled Fahrenheit one, of special hardened glass, having a stem diameter of not less than 6·75 m.m. or more than 7·25 m.m. Its total length should be between 335 and 350 m.m., the length between the 0° and 1000° marks to be not less than 285 m.m. or more than 300 m.m., the length of the bulb to the capillary 20 to 22 m.m., with a bulb diameter at the centre of 5·25 to 6·25 m.m.

During distillation, 1 c.c. of oil should pass over every minute; the receiver being changed as the mercury column just passes the fractionating point. When all the oil has distilled, the flask is disconnected from the condenser, inverted, and two burners used to complete the coking. The fractions are at every 50° Fahr.—*i.e.*, at 300, 350, &c. The thermometer should be so placed that the top of the bulb is opposite the middle of the tubulure; the flask during the distillation being properly shielded with a metallic cylinder.

Oxide.

In sampling, the oxide should be spread out into a bed of uniform height, and the upper surface divided into 6 feet squares. A hole is then dug to the bottom of the bed at the intersection of the lines, taking about two handfuls of oxide at the top, middle, and bottom of each hole. The sample so obtained is thoroughly mixed and quartered to a sample of about one quart. Metallic iron can be separated by a magnet; while the other components are determined in the usual manner. For differentiating between sulphur and tarry matters in the spent material, the carbon-bisulphide extract remaining in the flask is treated with about 25 c.c. of pure concentrated red nitric acid, gently warmed, and allowed to stand until all the sulphur has dissolved. It is a useless waste of time to hurry the oxidation; for if a high temperature is employed at first the sulphur melts, and in this condition is extremely difficult to oxidize.

After the sulphur has dissolved, add about 1 gramme of potassium chlorate, in small quantities at a time, to destroy all organic matter, and evaporate with concentrated hydrochloric acid until all chloric and nitrous fumes have disappeared, taking care that the evaporation is not carried to dryness. The residue is taken up with water, filtered, and the sulphur precipitated as barium sulphate. Prussian blue is extracted with caustic soda, and then titrated with zinc sulphate in the usual manner.

Tar.

Tar is sampled as in the case of ammoniacal liquor; the specific gravity being determined by the hydrometer, using the factor 0·008 for bringing to the standard temperature, which, it is recommended, should be 25° C. For greater accuracy, the use of a specific gravity bottle is advised. For the estimation of water, 25 to 30 c.c. of benzol is placed in a 250 c.c. cylinder, together with 200 c.c. of the well-mixed sample of tar, and the whole then poured into a copper still; the flask being well washed out with benzol, which, of course, is added to the still. The heating is from the top downwards, and is continued until 200° C. is reached.

To find the free carbon, 10 grammes of tar are weighed into a small beaker and digested with toluol on a steam bath. A cylindrical filter is prepared by folding two of the papers around a rod about ⅜ inch in diameter. The inner paper should be 14 c.m. diameter, and both should have previously been freed from fat by extracting with benzol. The filter cup is then dried at 100° to 110° C., and weighed in the weighing bottle. The contents of the beaker are decanted through the filter cup, and the beaker washed with hot toluol; the washing being passed through the cup. The filtrate is passed through the filter a second time, the residue washed two or three times with hot pure benzol, and transferred to the extraction apparatus, in which pure benzol is used as the solvent, which solvent is vaporized by means of a steam or water bath. The extraction is continued until the filtrate is colourless. The filter cup is then removed, dried, and weighed in the weighing bottle. Pure benzol, followed by chloroform, may be used instead of toluol followed by benzol. A Knorr flask and condenser are used.

Tar acids are determined as usual by extraction of the distillate with soda and reprecipitating with dilute sulphuric acid. In distilling in the presence of much water, the bulk of this latter should be separated before the distillation proper by heating (from the top downwards) in a copper still. The distillation flask to be a 250 c.c. Engler, having the following dimensions.

Diameter of bulb	8·0 c.m.
Length of neck	15·0 ,,
Diameter ,,	1·7 ,,
Surface of tar to lower side of tubulure	11·0 ,,
Length of tubulure	15·0 ,,
Diameter of ,,	0·9 ,,
Angle of ,,	75 degrees

Allowable variation, 3 per cent.

The dimensions of the thermometer, which reads to 450° C., should be the same as that used in oil distillation, with the exception that the length from the 0° to the 450° C. mark is to be 285 to 300 m.m. The burner and flask should be shielded during distillation. One hundred c.c. of the dehydrated tar is distilled at the rate of 1 c.c. per minute; the fractions being collected at the following points:—

Start to 110° C.
110° ,, 170° ,,
170° ,, 235° ,,
235° ,, 270° ,,
270° ,, 300° ,,

The percentage of fractions should be reported both by weight and by volume.

At the end of the paper are a number of useful factors, together with one or two tables. An index of ten pages is given of the samples met with, ranging from acetylene to the determination of zinc in brass. This does not claim to be a complete summary of the entire field, but is published primarily to bring out a discussion as to what should properly be included in such a handbook.

EVENT AND COMMENT.

[Communicated.]

The Supply of Coke-Oven Gas.

The results of the preliminary experiments in connection with the supply of coke-oven gas to Middlesbrough published in the "Journal" of the 29th ult. proved conclusively that the scheme is feasible in every respect. It has been stated on many occasions that a continuous supply of coke-oven gas of the required calorific value and illuminating power, and also of approximately constant composition, could not be maintained. Although those concerned with the application of coke-oven gas for town purposes could produce numerous instances of its successful application on the Continent, engineers in this country refuse to be convinced. The results obtained at Middlesbrough, however, by one of themselves, will surely remove the last traces of scepticism from the minds of British gas engineers. It is not, of course, suggested that coke-oven gas could be used in place of ordinary town gas throughout the country; but there are undoubtedly many cases where it would be very easy to bring about a co-operation between a bye-product coke-oven plant and a gas-works, with advantages to both parties. Colliery proprietors possessing coke-ovens are often faced with a difficulty in the disposal of their surplus gas. In the majority of cases, the gas is employed for the generation of power either by means of gas-engines or for boiler-firing purposes. In almost every instance there are periods every day in which this power is not required and the power plant is shut-down. During these periods the gas is necessarily wasted; and consequently, in arriving at the cost to be charged for the gas used, due allowance has to be made for the quantity thus lost. If, now, a colliery company could dispose of the whole of the surplus gas to a gas-works, and fire their boilers entirely by coal, there would be no loss of gas to contend with, and it could be supplied at a very cheap rate and still bring the same revenue as when it was used for power purposes on the plant. No doubt when the Middlesbrough results become more widely known and understood, such co-operation as is here suggested will become more general.

It is interesting in this connection to refer to results which have been recently published ["The Iron Age," U.S.A.] concerning a bye-product coke-oven plant in America which supplies gas for illuminating purposes. This is a plant operated by the Maryland Steel Company, United States, from which a portion of the gas is sold to the City of Baltimore for town purposes. The gas is obtained from a battery of Koppers regenerative ovens. The coal used contains 28 to 29 per cent. of volatile matter, and the gas is treated by the direct-recovery process before being employed for town use. As at Middlesbrough, the gas is separated into two portions—rich gas and lean gas—and while the former is used for town purposes, the latter is used for heating the ovens. A separate main is provided for each quality of gas. The rich gas, which amounts to approximately 5800 cubic feet per ton of coal carbonized, has a calorific value of 620 B.Th.U. Benzol is extracted from the lean gas, but not from the rich gas, and that extracted from the lean gas is added to the rich gas for enriching purposes.

Coke-Oven Bye-Products.

The position with regard to the coke-oven bye-products, tar, ammonia, and benzol shows a slight tendency to improve. Certain of the bye-products of tar distillation are in strong request—notably

carbolic acid, which is used for the manufacture of lyddite, and also creosote oil. Toluol is, of course, in great demand for the manufacture of tri-nitro-toluol. In this country some interest has been aroused by the recent circular issued by the "Committee on the Supply of High Explosives," and given in detail in the "JOURNAL" of the 29th ult. From this circular it appears that the benzol produced on coke-oven plants cannot be sold without a permit from the Committee. The object, of course, of such a system is to enable the Committee to have a full and complete record of the amount of toluene which is produced in the country, and thus enable them to check the ultimate destination of such toluene, and to take steps to prevent it finding its way to an alien enemy. There is no doubt that the authorities will do all in their power to assist the producers, and will place no unnecessary obstacles in the way of the disposal of the various products. Crude benzol contains an appreciable proportion of toluene, and, consequently, in case of necessity the Committee no doubt wish to place themselves in such a position as to obtain this toluene at the earliest possible moment, by requiring further fractional distillation on the part of the makers. On no coke-oven plant is benzol made which conforms to the specification issued by the Explosives Committee—viz., to distil 95 per cent. at 84° C. Such a product is practically benzene and contains no toluene; and it is, therefore, easy to see why, if the distillate conforms to this standard, no permit is required for its sale. The price of sulphate of ammonia is rather better than last month, and ammonia makers have been holding considerable quantities in stock on account of the state of the market. It is to be hoped that the sudden unloading of these stocks at the more favourable prices now in vogue will not cause another set-back. The difficulty with regard to the supplies of sulphuric acid mentioned in this column a short time ago still exists, though apparently there is every prospect of the demand being met in the near future.

MANUFACTURE OF DYES.

A scheme for the establishment of a national dyestuff factory in this country has now been announced, but it cannot be said that it meets with universal approval, even from those who are intimately associated with the dyeing industry. The heads of the Bradford Dyers' Association—a large combination of dyeing firms, and hence representing some of the very largest consumers—are disappointed with the scheme. It is not to be expected that everyone would be suited with the Government proposals, but one would think that an essential condition for the success of such a scheme as this is the whole-hearted support of the consumers of the products it is proposed to manufacture. No suggestion appears in the Government proposals of political apart from financial aid. Interest has to be paid on the capital which is to be lent by the Government—at a rate very little less than money could have been obtained elsewhere. The principal advantage in this connection is that the interest is allowed to be cumulative. It has to be remembered—optimistic as one may be—that Germany has a long start in the manufacture of aniline dyes. She has well-equipped factories, highly-trained chemists, and even skilled workmen, while we in this country have practically to start at the beginning. As long as the war lasts, the British dyer must pay what is asked if he wishes to have his dyestuffs. There is no competition, and only a very limited supply. Consequently also on account of this limitation, as well as because of a certain amount of inexperience in manufacture, the cost of production, and hence the sale price, will be high. After the war, if—as can only reasonably be expected—the Germans renew their activities commercially, how long can we expect the British dyer to pay a high price for British goods when he is offered an article at least as good at a much lower price? In order, therefore, to give us a fair chance, and to prove that we have the energy, skill, and enterprise to develop this trade, it is not only Government capital which is required, but also Government assistance in the shape of a protective tariff on such a scale as to give the home producer something like equality of opportunity until he gets upon his feet. It depends upon British public opinion as to how far such protection will be granted.

PRODUCTION OF METHANE.

A FEW years ago a French patent was taken out by M. Léo Vignon for a process for the manufacture of methane by conveying carbon monoxide over a mixture of hydrated lime and anhydrous lime in a tube maintained at a temperature of about 400° C. (752° Fahr.). M. Vignon has since patented a new process which consists in introducing steam into gas in a specified proportion, and then conveying it over heated anhydrous lime. The more recent patent is No. 469,907 of 1914, and the following particulars are taken from the specification.

Between 550° C. and about 850° C. (602° and 1562° Fahr.) carbonic acid remains fixed on the lime. The liberated gas consists mainly of hydrogen and methane, with which incompletely transformed carbon monoxide may be mixed. Temperature has an effect upon the speed of the reaction, which is greater at higher temperatures. Between 850° C. and about 1200° C. (2192° Fahr.) the carbonic acid is not retained, because the temperature is greater than the decomposition point of carbonate of lime. The lime is not transformed into carbonate, and can be utilized for a very long time. It acts as an intermediary substance in a catalytic manner. Within this zone also the temperature affects the speed of the reaction, which increases with rise of temperature. The composition of the gas obtained depends mainly upon the amount of steam added to the initial gaseous mixture and the speed at which the gas is delivered.

The presence of carbonic acid in the gas disengaged may produce, in the presence of lime, a certain number of accessory reactions which are reversible; and the quantity of steam to introduce at the outset is modified by them. It must be determined by experiment according to the particular gaseous mixture and the temperature. On the other hand, above 1200° C. the reactions which prevail are the destruction of methane by the steam and that of the carbonic acid by hydrogen; so that the greater the temperature above 1200° C. the smaller becomes the proportion of methane, whereas that of carbon monoxide increases.

The following are several examples of the application of the process, working with the gases or gaseous mixtures specified.

Pure Carbon Monoxide.—Carbon monoxide is conveyed into the water raised, in the first case, to a temperature of about 65° C. (149° Fahr.), and then run over a column of anhydrous lime brought to a temperature of 950° C. to 1000° C. (1742° to 1832° Fahr.). Before analyzing the gas obtained, the carbonic acid is removed by retaining it in an alkaline lye. The following is the composition of the gaseous mixture obtained:

	First Case. Per Cent.	Second Case. Per Cent.
Carbon monoxide	10·3	47·6
Methane	11·1	12·4
Hydrogen	78·6	40·0
	100·0	100·0

Water Gas.—Water gas is conveyed into water brought to a temperature of about 20° C. (68° Fahr.) in the first case, about 50° C. (122° Fahr.) in the second, and about 90° C. (194° Fahr.) in a third. Then it is conveyed over a column of anhydrous lime heated to a temperature of 700° C. (1292° Fahr.) in the first case and to 950° C. (1742° Fahr.) in the second and third cases. The carbonic acid is retained in an alkaline lye before analysis. The composition of the initial water gas was as follows:

	Per Cent.
Carbon monoxide	23·6
Carbonic acid	9·6
Methane	2·1
Hydrogen	64·7
	100·0

The composition of the gaseous mixtures obtained after the removal of the carbonic acid was:

	First Case. Per Cent.	Second Case. Per Cent.	Third Case. Per Cent.
Carbon monoxide	4·35	15·1	10·4
Methane	7·13	9·6	10·3
Hydrogen	88·52	75·3	79·3
	100·00	100·0	100·0

Gaseous Mixture.—This mixture had the following composition:

	Per Cent.
Carbonic acid	4·5
Carbon monoxide	8·1
Methane	10·1
Hydrogen	77·3
	100·0

This gas is conveyed into water raised to a temperature of about 20° C., and conveyed over anhydrous lime maintained at a temperature of 950° C. The carbonic acid is retained in an alkaline lye before analysis, and the following is the resultant mixture:

	Per Cent.
Carbon monoxide	5·8
Methane	12·6
Hydrogen	79·6

Mixture of Carbonic Acid and Hydrogen containing 74 per cent. of the latter gas. This gas is run over water at about 20° C. and over anhydrous lime maintained at 950° C. The remaining carbonic acid is retained in an alkaline lye before analysis. The following is the result:

	Per Cent.
Carbon monoxide	10·1
Methane	12·2
Hydrogen	77·7
	100·0

The process is applied as follows: Quicklime, in lumps, powder, a dry dehydrated paste, compressed blocks, or any other suitable form, is put into retorts or tubes of iron or refractory or any suitable material, which are heated externally. The temperature is raised to that which is admitted to be the best for the object in view, and the current of gas containing carbon monoxide is run into the retorts or tubes after having been moistened as explained. The gas issuing from the apparatus is purified according to the purpose for which it is required; the carbonic gas being removed if necessary.

ELECTRICAL POWER PLANTS IN GAS-WORKS: THEIR CHOICE, INSTALLATION, AND OPERATION.

By a "Gas-Electrical" Engineer.

When submitting this communication to the readers of the "Journal," the writer wishes to take an opportunity to express to the (to him) unknown author of the article upon the same subject which appeared in the "Journal" for Oct. 20 last his admiration of the care with which it has obviously been compiled, and of the exceedingly able manner in which it has been placed before the engineering public.

It was naturally hoped that the present publication would prove acceptable to readers of the "Journal;" but the writer never anticipated that its appearance would be heralded, so as to speak, by so excellent an article; and the degree of interest with which it is now read can only be enhanced by the prior perusal of an article that cannot fail to bring home forcibly to the reader the rapidly increasing part which electrical power is playing in the operation of gas manufacturing plants.

The electrical driving of machinery has been described as "one of those things the advantages of which always turn out to be greater than was anticipated, owing to the fact that the benefits are made up of a lot of small conveniences and time savings that it is difficult to enumerate effectively, and which it is impossible to carry in one's mind." The progressive gas engineer has no cause to be ashamed of the fact that he uses electricity on his power plant, nor need he fear that he is playing into the hands of his electrical competitors. He is simply justifying his claim to the title of an "engineer"—a man who, by the judicious choice and intelligent application of the forces of Nature, achieves a given object with the least expenditure of energy.

The engineer who introduces electrical power into his works is faced by innumerable problems, which only long and varied experience in this class of power transmission can economically solve. Mistakes made in the initial installation of a plant are frequently difficult to rectify when once it is put to work, and often result in part of the, if not the whole, plant operating under inefficient, and hence uneconomical, conditions. It is in the hope of preventing such mistakes and unnecessary initial expenditure that the following notes have been compiled.

Nothing speaks more eloquently of the broad-mindedness of, and the existence of, the true engineering spirit among gas engineers than does the truly catholic manner in which these officials, recognizing the possibilities of the electric drive, have utilized it in the undertakings they control. In so doing they have, in many cases, strikingly demonstrated the fact that, even in small installations, electricity can be generated by the employment of gas-engines at a far cheaper rate than many electric supply authorities can sell it to their consumers. In many gas-works using electricity for power purposes, the private electric generating station is a standing testimony to this fact; and it is gratifying to note that gas consumers all over the country are not slow to avail themselves of this means for the production of cheap electricity. The number of private plants for this purpose is steadily on the increase; electric picture theatres being particularly to the front in this respect.

The first problem which has to be faced by the gas engineer who proposes to lay down a private power plant is the type of supply which is most suitable to his own particular requirements; and seeing the extent to which even members of the electrical profession still wrangle and argue among themselves on these matters, he cannot be blamed if, after a brief survey of the subject, he relegates all things electrical to a far-distant and thermally unpleasant clime popularly supposed to be reserved for "The cohort of the lost ones" and "The legions of the damned." If he intends to take a supply from some external source, or to use that source as a stand-by, then, of course, the question of type of supply is decided for him. If, however, he decides to run solely from his own plant, then the principal points with which he will have to deal are:

(1) The system of supply, whether direct or alternating current. If the latter, whether single or multi-phase.
(2) The motive power for his generators.
(3) The type of plant and its rating.
(4) The transmission system.
(5) The best type of motors and control gear to be used.

System of Supply—Alternating or Direct Current.

This question is a vexed one on which users of the two systems have written and said much, based upon their practical and more or less limited experience. The day of the single-phase supply is admittedly past, so far as power jobs are concerned; and in considering the relative advantages of the two systems, it will be assumed that the fight lies between a direct current plant and an alternating current three-phase plant of low periodicity. Continuity of supply depends more upon the workmanship of the plant and the manner in which it is installed, and afterwards handled and maintained, than it does upon the particular type of plant laid down.

So far as the generating plant itself is concerned, there is very little to choose between the two systems, although it may be mentioned that in a plant the rating of which necessitates parallel running on economical grounds, a greater degree of skill and attention is required than is necessary on a direct current plant operating under similar conditions; also engines running alternating current machinery in parallel have to be adjusted to a greater nicety of speed than is needful in direct current sets.

The advantages and drawbacks of the system selected will be chiefly manifest at what may be termed the objective of the plant—namely, the units of plant that are destined to be operated by electric motors; and it is on this basis that the question of character of supply should be thrashed out. The chief advantage of the alternating current system is the facility with which the pressure can be changed by means of static transformers, and power sent at a high pressure and small amperage over long-distance transmission lines of comparatively small cross sectional area. The energy lost in transmission is proportional to the square of the current; and when it is remembered that the power transmitted through a given conductor is proportional to the product of the volts and the amperes, it will be readily seen that the higher the pressure at which the power is transmitted the greater is the amount of power that can be passed through the conductor with the same loss of energy.

The use of high-tension alternating currents is the only commercial method by which electric energy can be transmitted over long distances; but it is a very debatable point whether any advantage can be gained by installing alternating current plant in an area of supply the limitations of which do not warrant any advantage being taken of this particular characteristic.

Much has been said regarding the simplicity of the polyphase squirrel cage induction motor. It is, nevertheless, an undeniable fact that the majority of stator burn-outs on machines of this type cannot be rectified on the works—the entire machine having to be sent to its makers. A motor of this type can exert a starting torque equal to its full load torque, and in doing so takes from five to six times its full load current from the line. It is essentially a constant speed motor, and should not be applied to any load needing a high starting torque or speed regulation.

The provision of a wound motor connected up, *vid* slip rings, to a variable resistance enables a polyphase motor to exercise a starting torque of nearly 100 per cent. in excess of its normal full load torque, and also provides a method by which a certain degree of speed control can be obtained—the latter at the sacrifice of efficiency. The commutator and brush gear of the common or garden direct current motor have come in for a large share of abuse from polyphase motor enthusiasts; but it may be safely said that if a machine is looked after by a man who understands his business, the troubles attributed to these portions of the motor will be found wholly imaginary.

As an example of an industry in which the direct current type of motor is practically universally used, English street tramway systems may be mentioned. On the great majority of the cars in operation on our systems, two direct current 500 volt series-wound motors are used, and operate under particularly severe conditions—failures due to the commutator or brushes being extremely rare. The writer may mention that for the last two years he has had five crane motors by Messrs. Siemens Bros. under his charge, three of them working under extremely severe conditions. The latter are changed and thoroughly overhauled every six months; but their position when in use for this length of time is such as to utterly preclude the possibility of doing anything to either commutator or brushes. The other two motors, in daily use on a mono-rail telpher, have had nothing done to either commutator or brush gear for two years, with the exception of cleaning and the replacement of one set of carbon brushes in each motor.

The introduction of commutation poles to provide a reversed magnetic field to check the induction of a current in the particular armature coils undergoing commutation has made it practicable to obtain a shunt-wound direct current motor having a speed control ratio of about 1 to 4 effected solely by shunt regulation. Within limits, it operates quite sparklessly; while the method by which the speed is regulated does not detract from the efficiency of the machine.

The field (or stator) windings of all direct current machines are so arranged as to permit of any individual coil, either main or interpole, being disconnected, removed from the motor, and replaced *in situ;* while the highly efficient modern methods of impregnating and winding armatures render the possibility of their burning-out extremely remote. The conditions under which electric motors have to operate in a modern gas-works are identical with those pertaining in rolling-mills, foundries, and crane installations, and, as in the latter cases, can be best met by the installation of direct current plant. On a direct current plant, that *bête noire* of the alternating current man, the power factor, is entirely absent; while it is a well-known fact that fatalities due to shocks from alternating current circuits of comparatively low voltage are ominously frequent.

Steam-Engines versus Gas-Engines.

It is often the case that—due either to capital cost, conservatism, or want of trust in a new scheme—the proprietors of a works decide to lay down a small plant to start with. It is at this time that the temptation often arises to drive the plant from an existing,

and often limited, steam supply in preference to using what may be regarded as the works finished product—namely, gas. The electric plant must be regarded as a variable quantity. As soon as the advantages and the flexibility of the new drive are realized, new uses will be found for it. Old wasteful conveyor and elevator steam-engines will be replaced by electric motors, and a point will be reached when additional plant will have to be installed; and the chances are that either additional boiler power will have to be provided or else a gas-driven set laid down.

Except in cases where either the works costs into the holder are very high or the local price obtainable for coke is very low, it is better practice to lay down gas-driven generating sets in the first instance, and, by gradually replacing the old simple non-condensing steam-engine (or rather steam eaters), to reduce and possibly eliminate the steam generation charges. The latter may be impossible where there are steam-driven exhausters, as gas engineers as a whole are reluctant to place their "pull" at the tender mercies of an electric drive. But this is a point with which the author proposes to deal later in this article.

Another argument in favour of a gas-driven plant is that, if the gas consumed and the electrical energy generated are accurately metered, the working costs per unit generated can be easily ascertained; and the plant may prove a valuable asset in meeting electrical competition and increasing the engine consumption among those consumers who, in view of a practical example operating, so as to speak, under their very noses, may decide to instal their own generating sets in lieu of drawing a supply of electricity from the mains of a rival authority.

Steam-Driven Generating Sets.

While the use of steam-driven generating plants is not an attractive proposition when their installation involves heavy initial expenditure in the direction of steam-raising plant, there is a strong argument in favour of their employment on those works where there already exists a boiler plant of ample capacity. Electrical driving on gas-works often supersedes some form of mechanical power in whose operation steam has played the chief part. As a result of this, there is an existing battery of steam-boilers, one, at least, of which has to be kept under steam even under the altered conditions, in order to give a supply to the exhausters, retort-house settings, and numerous small pumps about the works. An inspection of the insurance company's reports will give a fair idea of the state of these boilers, and as to whether the time is at hand when the demands of safety will necessitate any considerable outlay in regard to them. In this connection it must not be forgotten that the time must come when the working pressure will have to be reduced, and it is as well to bear this eventuality in mind when declaring to the engine-makers the maximum available steam-pressure.

On many gas-works coke breeze and dust are a drug in the market, and tend to accumulate in such quantities as to render their disposal a matter of both difficulty and financial loss. There is no stronger argument in favour of the use of steam-driven generating sets than the efficiency and economy with which this low-grade fuel can be burnt over specially designed grates worked in conjunction with a system of artificially induced draught. In land practice forced draught is often produced by means of steam jets, either as an adjunct to mechanical stokers or else as merely supplementary to the ordinary draught. This type of blower is, of course, both cheaper to instal and simpler than an engine or motor driven fan, but is much more expensive in fuel costs; the power taken by a fan being only about 1 per cent. of the total power generated, while that taken by a set of jets will certainly be in the neighbourhood of 4 to 5 per cent. of the total power. In view, however, of the extremely low, and hence cheap, grades of fuel which can be burnt under these conditions of forced draught, steam-jets are extensively used on land installations; while for marine work, where both economic and cargo factors have to be studied, the power-driven fan is largely employed.

Type and Rating of Plant.

The type of engine to be used will be largely decided by the accommodation available and the capacity of the proposed sets. For comparatively small units the standard horizontal gas-engine has much to recommend it; while for large sets the faster moving multiple cylindered vertical gas-engine is a remarkably efficient machine. In either case it is recommended that the dynamos should be direct coupled to their respective engines. The load is bound to be a varying one, and compound wound dynamos having a level characteristic should be laid down. By a level characteristic is meant that the pressure of the current generated by the machine should remain constant over all load variations.

Rating.

Before deciding the number of units to be laid down, and their rating, a detailed and exhaustive survey of the whole of the existing plant should be made with a view to deciding the extent to which, in the future, electric motors will be used for general power purposes. The great aim must be to instal a plant that may be run at a fairly good load factor, and with correspondingly good economy. If this is to be attained, the only load extensions that can be considered are those which are likely to take place within a fairly reasonable time of the setting of the plant to work. A figure that must have an important bearing upon the rating of the plant is the ratio between the maximum day load and the night load. The latter demand will be created mainly by the retort-house plant, and will be a demand for power at regular intervals during the whole of the twenty-four hours. The day load will be made up of this demand, *plus* the demand made on the plant by motors scattered around the works, which only work during the daytime, and will constitute the maximum load which the plant will be called upon to carry.

Where, as in a small works, the difference between these two loads is not large, two duplicate sets may be laid down, each of sufficient capacity to deal singly with the maximum load. It must, however, be borne in mind that with an increasing difference in the two loads, the efficiency of this arrangement will correspondingly decrease; and where the night demand cannot provide an economical load for a set the plant must be rated on an entirely different basis.

In deciding the capacity of a power plant, an estimate should be prepared (making a reasonable allowance for extensions) showing the total number of motors which will be operating at the same time. The efficiency of the various motors must be taken into consideration; and in this connection it may be pointed out that high-speed motors have a relatively greater efficiency than slow-speed machines provided they are run at a fairly high load factor. In order to grasp the factors which decide the rating of a plant, let us consider the case of a typical horizontal retort-house having (say) twenty benches operated by a simultaneous type of machine, to which, for the sake of brevity, we will hereafter refer as the "charger." This machine will draw its supply of coal from a series of overhead hoppers running the entire length of the settings, and these hoppers will be kept supplied by means of a coal conveyor running over them. The conveyor will be supplied by an elevator, the boot of which is situated in an adjacent coal-store. This conveyor, working in conjunction with the elevator, will keep the hoppers filled during the hours from 6 a.m. to 6 p.m.; while the capacity of the hoppers will be such as to keep the charger supplied during the night. A conveyor running the whole length of the settings on the discharge side of the house will convey the coke away from the front of the retorts.

Summary of Power Required.

The maximum demand created by this plant may be summarized as follows:—

	B.H.P.
Charger (on pushing stroke)	20
Coke-conveyor	15
Coal-conveyor	15
Coal-elevator	15
	65

A 15 B.H.P. shunt-wound motor, running at (say) 900 revolutions per minute, will have an efficiency of about 87 per cent., which figure we will assume to be the efficiency of the three 15 B.H.P. motors mentioned above; while the motor on the charger will, on the pushing stroke, be operating at a much lower efficiency. We shall, however, be safe in assuming an average efficiency of 80 per cent.; and applying this figure to the demand already expressed in brake-horse-power, we find that the maximum demand will be:

$$\frac{65 \times 746 \text{ (watts per horse power)} \times 100}{80 \times 1000} = \text{say } 61 \text{ kilowatts.}$$

In other words, a dynamo must be installed capable of giving a current of 277 amperes at a pressure of 220 volts—the usual pressure for direct-current power plants of moderate size.

An interesting point now presents itself—namely, the ratio between the day and night loads; and the figures shown above will be useful in illustrating the remarks that have already been made on this subject. We will assume that a 70 kilowatt generating set—the question of duplicate plant does not affect this argument—has been laid down to meet the demand outlined above. Neglecting for the moment those periods in the daytime during which the charger and the coke conveyor are not working, we have a 70 kilowatt plant working under a load factor of about 88 per cent. when the charger is exerting its full power on the forward stroke and about 60 per cent. when the machine is standing in readiness for the signal to charge. During the night hours, when only the charger and coke conveyor are at work, we have a load factor (taking the same basis) varying from 20 per cent. to 50 per cent.

In a retort-house of twenty benches all at work, the total time during which the charger and the coke conveyor would be idle would be something in the neighbourhood of eight hours out of the twenty-four. This eight hours would be made up of short intervals varying from 30 to 80 minutes, according to the charges and the method of working. At night the generating set might advantageously be shut-down during these periods; but in the daytime there would be about a total of four hours during which the set would have to run on the load provided by the coal elevator and conveyor—viz., a load factor of about 40 per cent.

It will thus be seen that it is impossible to avoid having, at certain times, to run under a very poor load factor; and this becomes all the more obvious when it is mentioned that it is only on the charging or pushing stroke that a stoking machine of the type under consideration exercises its maximum power. The travelling motion may create a demand for about 5 to 6 B.H.P.; the withdrawing of the fire length about 4 to 5 B.H.P.; and the raising and elevating gear about 7 to 8 B.H.P. It is only on the forward stroke that the maximum demand occurs; but it is on the basis of this forward stroke that the plant has to be rated. At all other periods of the operation the charger motor is only lightly loaded.

Even if a small set were installed for dealing with the night load it is evident that it would frequently be operating under a load factor of below 50 per cent.; and it is in this connection that the advantages of a battery, as dealt with in a later portion of this article, become apparent. A battery would help a small set over this short peak load, and would permit of a smaller set being installed for night work than would otherwise be practicable.

Before passing from this example, it may be of interest if we consider the capabilities of this plant and its probable cost of operation. Its maximum capacity will be 70 Board of Trade units per hour, or a daily output of 1680 B.T.U. When supplying the load which we have taken as a typical example, the daily demand will be about 350 to 400 B.T.U.; while the daily load factor will be in the neighbourhood of 23 to 27 per cent. This factor, it may be explained, is the ratio (expressed as a percentage) which exists between the actual output and the possible output had the maximum demand been steadily maintained during the whole of the twenty-four hours.

If this plant were run at its full rated capacity, with gas at (say) 2s. per 1000 cubic feet, making a liberal allowance for oil, attendance, interest, and depreciation, and allowing also a liberal brake-horse-power-hour efficiency, electrical energy would be produced at about 0·7d. per Board of Trade unit; while the charge for gas alone would work out at about 0·57d. per B.T.U. The installation of a 70 kilowatt set for the day load and a 30 kilowatt set for the smaller night load would have the effect of raising the load factor, and would lead to a corresponding reduction in the working costs.

The kilowatt capacity and the rating of the plant having been decided, the brake horse power of the engines installed may be safely left in the hands of the contractors supplying the sets. The following, however, is the method by which this figure is arrived at, which, it will be seen, is the inverse calculation to that used in the determination of the motor demand. The power required at the engine-coupling, expressed in watts, will be the maximum overload capacity of the generator *plus* the watts lost in the conversion from mechanical to electrical energy. This loss, expressed as a percentage, is termed the efficiency of the dynamo, and, as in a motor, varies with the size and efficiency of the machine. A 70 kilowatt dynamo running at 220 revolutions per minute would have an efficiency of about 90 per cent. at full load. The watts required at the engine coupling will therefore be

$$\frac{70 \text{ K.W.} \times 1000 \times 100}{90} = 77{,}777 \text{ watts.}$$

1 H.P. = 746 watts. Therefore the horse power required will be

$$\frac{77{,}777}{746} = \text{(say) } 105 \text{ B.H.P.}$$

(To be continued.)

COKE-OVEN GAS FOR BALTIMORE.

A recent number of "The Iron Age" contained particulars of two new batteries of bye-product coke-ovens which have been installed at the works of the Maryland Steel Company, and from which gas is piped to Baltimore for lighting purposes. The work was designed and installed by the Koppers Company, and the following are some of the details.

The ovens are near the three blast-furnaces. Coal arriving at the plant by rail may be used immediately or stored and subsequently reclaimed by a revolving coal-bridge, 280 feet span. A mixture of coal containing 28 to 29 per cent. volatile matter is used. The coal, after crushing, is of such fineness that about 75 per cent. will pass through an $\frac{1}{8}$-inch mesh sieve. Coals mixed in the desired proportion are elevated to a 100-feet coal-tower, and delivered to a belt conveyor which carries them into the bin serving the two new batteries.

Each battery of ovens comprises a space of about 235 feet in length and 40 feet in width, exclusive of the pusher foundations. The oven chambers are 18½ inches wide at the pusher end, and 21 inches at the coke end. They are about 10 feet high, and 37 feet long between the doors. The gas off-takes are arranged on the pusher side. The regenerators are located below the oven chambers; each oven having its individual regenerator. At the end of each battery the reversing machinery is installed, which at intervals of half-an-hour, by means of wire cables, automatically operates the gas-cocks and air-valves as well as the reversing dampers.

Each oven has a gas-ascension pipe on the pusher side. The gas is separated into a rich and a lean portion. For this purpose two collecting mains are installed. To them four suction-pipes are connected, two of which carry the rich gas and two the lean gas. The division of the gas is made by means of butterfly valves, in such a way that the gas of the first part of the coking period is allowed to enter the rich-gas main, while the gas evolved during the latter part enters the lean-gas main by manipulating the valves at a certain time.

The rich and the lean gas enter the primary coolers. The tar and weak ammoniacal liquor precipitated therein are drained off at the bottom and piped to the hot drain and tar-flushing tank. The gas then enters the bye-product building, which contains three rows of apparatus—one for rich gas, one for lean gas, and one held in reserve. The present bye-product building is 86 feet wide by 160 feet long, and is subdivided by walls into a sulphate storage room 40 feet long, the apparatus room 80 feet long, and a still room 40 feet long. There are three turbo-exhausters to deal with all the gas produced. Each has a delivering capacity of 15,000 cubic feet per minute against 4 lbs. pressure, and is provided with a regulator to maintain a constant pressure on the suction mains. The exhausters draw the gas from a main located in front of the primary coolers.

About 5800 cubic feet of rich gas per ton of coal carbonized, having an average heating value of about 620 B.Th.U., is delivered to Baltimore, and about 4450 cubic feet of lean gas, of about 490 B.Th.U., is used for coking. So of the total quantity of 10,250 cubic feet of gas produced per ton of coal, only a little more than 43 per cent. is used for carbonization, while nearly 57 per cent. is surplus gas. Reduced to the B.Th.U. basis, the requirements for coking are only 38 per cent., while 62 per cent. of the total heat value of the gas is available for outside purposes.

At the present time, with only one battery in operation, the total surplus gas is furnished to Baltimore. Provision is made, however, for future use of a portion of the surplus gas in the steel plant. To this end a gas bye-pass is installed between the mains for rich gas and lean gas after the final coolers. This bye-pass is equipped with a gas-seal to permit the gas to travel only in one direction, so that rich gas may flow into the lean-gas main while it is impossible for lean gas to find its way back into the rich-gas main. This feature serves to provide an automatic adjustment of the quantity of rich gas furnished to Baltimore according to the demand. Since the bye-pass is located between the final coolers and the benzol washers, the benzol is extracted also from the portions of the rich gas which, owing to reduced demand on the part of the city, enters the lean-gas system through the gas-seal.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

Visit to the Harrow Gas-Works.

Members of the Association on Saturday afternoon assembled at the Roxeth works of the Harrow and Stanmore Gas Company, where they spent both a pleasant and a profitable time. On arrival, they were met by Mr. J. L. Chapman (the Engineer and Secretary), Mr. C. Chambers (the Assistant Manager), and Mr. H. J. Carpenter (Draughtsman). During the subsequent inspection of the works, much interest was evinced in the modern plant to be seen there. In the retort-house the members were informed that the coal charges were 10 cwt. with an eight-hour run. The electric telpher for picking up the discharged coke, and conveying, quenching, and depositing it on the coke-heap, and the carburetted water-gas plant came in for attention, as did also the water-softening system.

A previous visit was paid by the members of the Association to Harrow some years ago [see "JOURNAL" for May 15, 1906, p. 439]; but, of course, various improvements and extensions to the works have been carried out since that time, as the following notes, which were prepared for the Association in anticipation of last Saturday's visit, will show.

The works are situated on a piece of land of about 10 acres, only 5 acres of which are at present occupied. A double line of railway connects the works with the Metropolitan Railway.

The coal gas is manufactured at the present time in a retort-house constructed in 1912, in which there are six benches of eight through retorts, each 20 feet long and 24 in. by 16½ in. The charging and discharging of the retorts is done by means of a Fiddes-Aldridge simultaneous machine; and the coke is removed by a telpher plant, and is quenched in an outside tank, and then delivered on to the coke ground. The telpher is so arranged that it can be used for loading coke into railway trucks. The coal is delivered into the bunkers and into store by a combined elevator and conveyor of the Babcock and Wilcox design. It is practically noiseless; and there is a tunnel under the store by means of which coal is moved from the store to the bunkers without manual labour. There is a second retort-house with inclined retorts, which is not at present in operation; but when further manufacture is necessary it will be brought into use, as the costs with this house are quite low.

The condenser is a Clapham water-cooled reversible one. It is intended to use a "Cyclone" tar-extractor as soon as it can be completed. After this come the exhausters, followed by a Livesey washer. Then a Kirkham-Hulett vertical centrifugal washer, and after this a rotary-washer containing carburetted water-gas tar.

The oxide purification is by means of four luteless boxes, each 25 ft. by 25 ft. square, working in rotation. The gas-inlets are at the top of the boxes, and the outlets at the bottom. These are followed by a catch-box, 25 ft. by 20 ft.

The carburetted water-gas plant was erected by Messrs. Cutler and Sons in 1899. There are two sets of apparatus, one capable of producing 400,000 cubic feet, and the other 300,000 cubic feet per 24 hours. The larger plant is exactly the same as the smaller, with the exception of the generator. This has lately been enlarged, and works satisfactorily with the rest of the old plant. For the condensation of the carburetted water gas, it is first passed through a horizontal air-condenser, and then through water-tube vessels. To complete the process and remove all

particles of oil, the last vessel is a Livesey washer containing pure water. The purifiers are four boxes, each 18 ft. by 12 ft.; and no oil deposits are found in these vessels. The warm water from the carburetted water-gas condenser is carried to a Boby softening tank, with large storage, for use in the boilers. The whole of the water is pumped from an artesian well sunk within the Company's boundaries.

Sulphate of ammonia is manufactured upon the works; and this plant has been much improved by certain small alterations.

The coal-gas exhauster-house contains a pair of Donkin's exhausters working on one engine for 60,000 cubic feet per hour, and a pair of smaller exhausters of the same type for 30,000 cubic feet per hour. For the carburetted water gas there are two separate exhausters, both of the Donkin type, and of a capacity of 30,000 cubic feet per hour. In the house with these there are two high-speed engines for the blast to the carburetted water-gas generators. This house also contains two vertical Browett-Lindley steam-engines for driving direct two dynamos for generating electricity for working both the Fiddes-Aldridge machine and the telpher plant.

There are two main gasholders for distribution to the district, one containing 1,150,000 cubic feet, and the other 350,000 cubic feet. There is also a smaller holder containing 140,000 cubic feet, which is only used for the carburetted water gas.

A Price's "Simplex" vaporizer has been lately erected to deal with the naphthalene, which has been a source of great trouble in the districts. On Dec. 8, 1913, there were 27 stoppages; but on Dec. 8 last the number was reduced to two.

The mileage of mains in the district is about 100, and the number of consumers is 5750 by ordinary meter and 6500 by prepayment meter—being a total of 12,250. The number of public lamps is 1570. The annual make of gas is 343,000,000 cubic feet, and the maximum daily output 1,302,000 cubic feet.

On the conclusion of the inspection, high-tea was served in the Board-room, after which

Mr. CHAPMAN expressed his pleasure at seeing the members—especially as they were visiting a small works. As an evidence of the growth of the Company, he would give a few figures which might prove interesting, as showing the expansion that had taken place since the last visit the Association paid to the works, in May, 1906, with Mr. Walter Grafton, their then President. The works then occupied 2½ acres, with 2½ acres spare. Now they occupied 5 acres, with 5 acres of reserve ground. New railway-sidings had been made direct into the works, a new retort-house and machinery had been erected, and a further holder, with a capacity of 1,150,000 cubic feet, had been put up. In 1906 they had but 4400 consumers; now they had 12,250—5750 ordinary and 6500 prepayment. At the last visit of the Association, the total make was 130 millions; at the end of last year it was 343 millions. The Company had an area of 36 square miles.

The PRESIDENT (Mr. J. Hewett) spoke of the appearance of the works, which, instead of having the characteristics of an old works, looked in its infancy, so complete and modern was it, with the very latest types of plant.

Mr. F. C. BRIGGS proposed a very hearty vote of thanks to Mr. Chapman and the Board of the Company for permitting them to visit the works, and for the kindness shown them while there. He referred to the excellent condition of the works, and the extreme order and cleanliness visible everywhere.

Mr. F. A. FROST seconded; and said that there were several things they appreciated in a works of this size. The members were enabled to follow the whole process of gas making, and to see things which one could scarcely realize on a very large works.

Mr. W. J. LIBERTY, in supporting the vote, remarked on the complete "up-to-dateness" of the works, and on the large amount of scrapping that must have taken place. It was good for junior members, who were in their educational period, to visit a works of this size, where they could see the complete system of gas making, from start to finish. He also thanked the management for their hospitality, and said that he wished to be included in the vote the names of Mr. Chambers and Mr. Carpenter.

Mr. CHAPMAN, in reply, thanked the members for their vote, and said they were all very pleased to help in any way the Junior Association. He was glad to hear the references to the good order on the works, which he trusted would be an object of both beauty and utility to the neighbourhood.

Mr. CHAMBERS then made some interesting remarks of a practical nature helpful to juniors, in connection with his long experience of 25 years with the Company. Most of them referred to troubles that happened at Christmas time. He bore out the statement made by Mr. Liberty, that it was to works of this kind that the junior members could come and learn things connected with the industry—especially after they had been "departmentalized" in larger works. He was pleased to say that the change from old to new in their machinery had not adversely affected their capital account, which was still going down. Their increased output last year was 24 million cubic feet, equalling 7·59 per cent. This year, so far, it was 3·67 per cent. up, in spite of the diminished lighting. He could not conclude without testifying to the kindness he had received from Mr. Chapman during his long period of service with the Company—a kindness which was most uniform, and extended to every man on the works.

Manufacturers can derive much useful information as to the utilization of the waste heat of the exhaust gases of internal combustion engines and industrial furnaces, by the study of a pamphlet on the matter issued by the Bonecourt Waste Heat Boiler Company, Limited, of Parliament Mansions, S.W. The Company have specialized in this subject, and have standard designs of steam-boilers and water-heaters to meet the many different conditions of actual service.

HEATING, VENTILATION, AND REFRIGERATION.

Report by a Committee of the American Commercial Gas Association.

At the last Meeting of the American Commercial Gas Association, the Committee on Heating, Ventilation, and Refrigeration, of which Mr. G. S. Barrows is the Chairman, presented a report of which the following are the principal portions.

HEATING.

It was hoped that we should be able to conduct experiments to give certain efficiency values to various types of heaters and make recommendations for their installation. Unfortunately, it was impossible to properly prosecute this line of investigation, and so it was deemed best to make a study of the methods and appliances most in use, or considered most desirable, and briefly discuss their advantages or disadvantages.

We sent a circular to 83 members of the Association, and replies were received from 50. In it we asked for an expression of opinion on the types most desirable for certain specified purposes, and we believe the replies represent personal opinions, governed, of course to some extent, by the practice of the company with which the person is connected. The questions were prepared with a view to covering as much in detail as possible the different classes of rooms in which heaters are installed and the various types of heaters and connections. In a number of cases complete replies were not received, and we assume that those answering had no definite choice of appliance or method. A summary of the replies received is given in the table (p. 83); the places where the heaters were installed being indicated by letters as follows: A, living-room; B, bedroom; C, schools, churches; D, theatres; E, stores; F, offices; G, warehouses; H, workrooms.

The answers apparently indicate that in rooms where the space occupied by the heating appliance is of considerable value to the occupant, a portable heater, which may be removed for storage during the part of the year when it is not in use, or may be shifted to a corner of the room, is preferable to a stationary heater. A general exception to this rule is in rooms where fireplaces are available for the installation of heaters.

There is no decided preference, when illuminating flame burners are used, for the flat-flame over the round or jet burner; but the Committee believe that the flat-flame burner is preferable if the proper type of burner is used, because there is less liability for it to blow or extend beyond the heater, and become a possible source of danger in case of an increase in pressure.

We are surprised at the number expressing a preference for asbestos-back heaters. There are two general types of this heater. In the first the burner is at the bottom of the back; in the second (the one that is more commonly used) the back is a perforated plate with burner orifices all over the surface. The first type has no very objectionable feature, though it is not particularly sightly, because only the lower part of the asbestos becomes incandescent. The second type is neither efficient nor desirable, because of the difficulty of getting sufficient secondary air to the upper burners, which lie directly in the path of the products of combustion from the lower orifices, and there is not perfect combustion from the upper burners. The asbestos fibre, unless carefully maintained, is apt to become unsightly; and the expense of proper maintenance is not small.

The marked preference for radiators of the gas-steam type is interesting. Considering the amount of energy in the form of heat obtained from the gas, they are neither more nor less efficient than any other good heater. When the gas is lighted there is a perceptible lapse of time before heat is given to surrounding objects, due to the absorption of the heat by the water; and after the gas is turned off there is a similar period during which heat is given off while the heater is cooling. As one of the advantages claimed for gas heating is instantaneous heat when wanted, and immediate cessation of the heating when turned off, it is interesting to know why this form of heater is preferred.

The Committee believe that the very pronounced desire for solid pipe connections should be gratifying to the Association, and that efforts should be continued to increase their use. Recent developments of flexible tubing having a flexible metallic core covered with a gas-tight composition have greatly increased the value of flexible tubing; and a number of solid connections, mostly of the union type, have been devised to take the place of the present slip end. While none of these connections has been found to be entirely satisfactory, from among them some can be selected which will probably prove commercially successful. There has recently been a marked improvement in the slip end; it being made of better quality rubber, and corrugated internally to reduce the probability of accidental displacement.

Your Committee make no comment on the answers to the questions on flue connections, except to express the opinion that these are desirable where possible, and where not objectionable to the consumer. This is especially so where heaters are used for continuous heating, as unless rooms are particularly well ventilated there may be annoyance from the condensation of the aqueous vapour in the products of combustion. The use of the damper is referred to; and your Committee recommend that where one is used particular care should be exercised to see that it is so constructed, either by perforations or by making it a loose fit in the pipe, that it will be impossible to close the flue entirely.

We are glad that many of those who replied to the circular did

—	Type of Heater.		Kind of Burner.								Method of Connections.							Material or Finish of Heater.				
			Open Flame.				Atmospheric.				Gas.				Flue.							
	Stationary.	Portable.	Reflector Type.	Radiator—Round Type.	Jet Burner.	Flat-Flame Burner.	Radiant Body.	Asbestos Back.	Gas Log.	Gas-Steam Radiator.	Solid Pipe.	Slip-End Flexible Tube.	Screwed-End Flexible Tube.	Union-End Flexible Tube.	Without Flue.	Flue and Damper.	Flue and no Damper.	Steel.	Cast Iron.	Brass, Copper or Bronze.	Aluminium.	Enamel.
A	30	20	28	1	16	15	9	6	11	2	30	13	1	7	26	12	7	16	8	15	..	11
B	17	32	33	6	17	20	10	2	1	3	23	19	3	8	30	5	7	24	5	7	2	17
C	41	3	10	8	8	12	8	1	1	26	43	3	..	5	26	4	6	13	20	6	6	7
D	74	1	8	7	7	9	9	1	1	30	45	1	..	1	28	3	6	14	2	6	7	5
E	40	5	9	8	10	6	8	1	1	31	39	5	..	2	28	4	5	13	22	5	7	3
F	28	22	17	7	13	15	11	1	1	22	31	2	3	6	34	2	4	16	21	5	5	13
G	31	13	9	11	9	11	10	1	1	23	33	7	1	5	29	4	4	15	18	4	5	4
H	30	18	18	13	9	14	10	1	1	22	35	7	1	7	29	3	6	19	19	4	4	8
	261	114	126	61	89	102	75	14	18	159	279	67	9	41	230	37	45	130	115	52	36	68

not confine themselves to the tabular form, but added remarks, some of which are quoted in the appendix.

Use of Room Heaters.

Because of anticipated tests of room heaters, no inquiries were made regarding desired sizes. As the tests were not made, no recommendation is possible; but we believe that the phase of the subject should have careful consideration, for if the heater is either too small or too large the service will be unsatisfactory. The disadvantage of the small heater is obvious. The disadvantage of the large one disappears if it is connected to a flue, for it is objectionable only because of the vitiation of the air—a point touched upon in the part of the report referring to ventilation.

Care must be exercised, in selecting heaters, to use those which do not become dangerously hot. The temperatures below and on the sides and back should not be so high as to cause scorching of the floor, walls, or furniture near the heater. The front of the heater should be so protected that inflammable fabrics will not become ignited, even if not touching it.

It is assumed that only heaters in which combustion is perfect will be used. Perfect combustion is readily obtained with illuminating flame burners if the air supply is ample and the flames do not touch any part of the heater. Similarly perfect combustion can be obtained with atmospheric burners. As the latter do not quickly show carbonization if the tips of the flames come in contact with a part of the heater, it is often assumed that such contact is unobjectionable. This should not be permitted; for unless the part touched by the flame is as hot as the temperature of ignition of the gas, there will be imperfect combustion. Because of this tendency to the improper use of atmospheric burners, and the possibility of flashing-back, it is desirable to use illuminating flame heaters when flue connections are not made, except in rooms that are at all times well ventilated. Care should be taken to keep all heaters clean, and the air supplied for the burners or for passages over the heated surfaces as free from dust as possible. If attention is not given to this, complaints of odour are likely to occur.

Central Heating.

Your Committee have been unable to obtain sufficient information on central heating to make any general recommendations. While central heating for the entire season is not often practical, an auxiliary central gas heater is frequently economical, and always an added convenience. In the spring and autumn there are periods of weeks when, at times, the house needs the chill taken off in the morning and possibly again in the evening. To operate a coal-fire for this, even if for several days in succession, is both an expense and a nuisance; and as the need is usually intermittent, gas is obviously the best fuel. As the quantity of heat required is considerably less than is demanded for mid-winter, a small heater suffices. It should preferably be placed close to the coal heater, and connected to the heat-distributing system, which may be hot air, hot water, or steam. As coal heaters vary in type and size, it is often necessary to build a heater to suit the particular installation, especially when a hot-air system is used. Several manufacturers are now building such appliances, and it is quite likely that these will prove more nearly universal than has been supposed. For hot water or steam systems almost any gas water-heater or steam-boiler may be used. Your Committee recommend a more energetic campaign to secure this business, for which gas is so admirably adapted.

Another kind of heating, which may be termed "central heating," is the use of gas-steam radiators in connection with low pressure steam-heating systems. Most gas-steam radiators are so designed that they may be connected to the central heating system, and used with steam from the central plant—gas being used with them only when the central plant is not in operation. Such use is very desirable for intermittent heating during the spring and autumn, and throughout the winter for large buildings which for one or more days during the week may not be generally occupied. In such places it is not desirable to operate the central plant, and the few rooms which are occupied may be heated by lighting the gas under the radiators.

All-Gas Kitchen Heating.

The increasing number of all-gas kitchens has shown the need for some means of heating kitchens other than by the gas-range ovens. In most modern houses heat is provided, but the older houses depend on the coal-range, which at the same time heats the water for domestic supply. To keep the gas-range in use during the winter is highly desirable; and this may be accomplished by the installation of a coal-fired hot-water heater or a furnace connection supplying hot water for a radiator to heat the kitchen, and also for the domestic supply through the usual tank or boiler.

Ventilation.

This subject, unless limited, is obviously too broad for consideration in such a report as this; so your Committee will confine the discussion to such phases as apply to rooms in which gas is or may be used primarily for lighting, heating, or similar purposes, and by proper application be made to assist in the ventilation. Seldom does the air of any room become dangerously vitiated except through the carelessness of those who are responsible for the conditions. Insufficient provision for the admission of fresh air or for the escape of foul air, or, if there is sufficient air under ordinary circumstances, overcrowding, or the improper use of appliances, will cause poor ventilation. We should not be satisfied simply to prevent such unhealthful conditions, but should attempt to provide comfort by keeping the air free from disagreeable odours, and its temperature from becoming excessive. Under ordinary conditions, a complete change of air four times an hour will suffice. In a crowded or overheated room the air should be changed six times. The change of air may be effected by fans or by allowing the warm air which rises to escape freely—its place being taken by cool fresh air entering. Ventilation induced by the escape of warmed air is obtained only at some loss of efficiency in the means for heating; but the loss is not excessive when compared with that of operating a mechanical system. If the heated air is from lights, there is no loss; and where proper ceiling outlets are possible, an ordinary room may be cheaply and satisfactorily ventilated by this means alone, if the flues are practically vertical and so short that the air therein is kept appreciably warmer than that into which it is escaping. This method is best for buildings of one storey; and it may be employed where there is one main flue into which flues from each floor discharge.

In England and on the Continent a good many rooms, both public and private, are ventilated in this way with considerable success. In America there have been relatively but few such installations, but where they have been made they are successful. One gas company, in its new office building, provided ceiling ducts and wall outlets; and it is reported that the ventilation is very satisfactory. In another city the gas company, in a one-storey district office, with a large number of appliances and lights burning throughout the day, avoided the expense of fans by installing ventilators and a fresh-air duct beneath the floor—changing the atmosphere from one excessively vitiated to approximately normal.

The formula for the rate of discharge of air through a flue is the same as for draught in a chimney. It is somewhat difficult to determine the exact temperature which should be used, for there are a great many factors to be considered, not the least of which is the cooling of the air of the room by the opening of doors, particularly in the case of stores. By using thermometers, the average temperature near the ceiling may be obtained, and the average outside temperature can be assumed, remembering that the volume of air discharged will be less in summer than in the winter, because of the smaller difference in temperature between the air in the room and outside. In any case, the difference between the air inside and outside is relatively small; and because the direction and force of the wind, the proximity of adjacent buildings, and atmospheric conditions all have a marked effect on the draught, it is recommended that, except under very favourable conditions, some mechanical means of ventilation should be used. It is urged that this matter of non-mechanical ventilation should have further consideration, and that its possibility should be carefully studied.

Many exhaustive studies have been made of the effect on the atmosphere of burning gas; and it seems pretty well proved that there is some sterilizing effect, because of the passage of large quantities of air through the flames. The most noticeable effects in a poorly ventilated room are odours and excessive heat. The odours are generally not from the products of combustion, but from dust burnt or in contact with the hot parts of the heater, or sometimes from the material of the heater itself. To avoid these odours it is necessary to see that the heater is thoroughly "burnt off" before installation, and kept clean. Overheating is generally perceptible in rooms heated by some other means than a gas-heater, and is usually found where gas is used only for lighting. Where it is impossible to provide ducts to carry away the heated air from the upper part of the room, the temperature will seem high, not only because of the accumulation of this heated air, but also by radiation of heat from the ceiling heated by the air. Usually this high temperature can be avoided by opening the windows slightly top and bottom; or by providing some other means for an inflow of fresh air the heated air will escape, and the temperature of the room will be satisfactory.

When the heater is set in a fireplace or connected with the flue, the ventilation of the room is very much improved, because there is an appreciable flow of air induced by the escape of the products of combustion. There will, however, still be the possibility of high temperature from the collection of heated air in the upper part of the room and odours caused by the contact of dust with the hot surfaces of the heater. The odour in a room heated by gas should not be more noticeable than in a room heated by other means, though where low-pressure steam or hot-water radiators are used there will be less odour from burning dust, because of the relatively lower temperature of the heated surfaces. If electric radiators are used the conditions will be the same as with gas, for the temperatures of the heaters are about the same.

While a certain amount of air is required for maintaining combustion in gas-heaters, and therefore more air should be admitted when these are used than when steam or hot-water radiators or electric heaters are installed, the general properties of vitiation are the same, and the same precautions should be used to provide fresh air.

Refrigeration.

The use of gas-operated refrigerating machines is of relatively recent development, though some machines have been in use for several years. They are all of the absorption type, in which heat is required only for vaporizing the ammonia, and any means of heat would do as well. Most of the systems on the market are of the non-automatic type—that is, the valves controlling the cycle are operated manually. There is, however, one machine in which the control is by thermostatic and pressure means.

The Committee have made many inquiries regarding these systems, and find there have been so few installed that they are not justified in making any recommendation at present. When it is possible to provide a proper system of inspection or maintenance, it is believed that the automatic type will prove satisfactory, and that the cost of refrigeration to the consumer will be less than where ice is used. In all cases large quantities of water are required for condensation, and the Committee believe the cost of water has generally been under-estimated. Where careful and constant supervision is not possible, your Committee believe that the automatic type should not be recommended. As in the non-automatic systems a number of valves must be operated in their proper sequence, the installation of such a machine is not desirable except where the operator is able to understand the function of the various parts. Your Committee recommend, in view of the large field for refrigerating apparatus of the absorption type, that the manufacturers of these machines should be encouraged to develop them by making installations which may be under the supervision of the gas company, until such time as the practicability of the machine is assured, but that a general installation of these machines is not desirable at present.

Appendix.

Remarks on Replies to Tabulated Questions.

"We endeavour to instal heaters with iron pipe connections; otherwise we use metal tubing. We recommend the reflector and radiant types, but where the question of expense arises we use the open flame round heater."

"Solid connections always where possible on any appliance, and on logs and fireplace heaters always. Asbestos back heaters should be flue connected."

"Bronze finish preferred on all types of gas-steam radiators."

"Fireplace heaters desired wherever possible."

"The gas-steam radiators connected solid, and used as auxiliaries with the usual steam-heating system, is my preference. In most cases flues would not be available."

"In all cases where we have marked 'without flue,' it assumes the room is large and well ventilated."

"Stationary type of heater preferred, because it means permanent gas heating. But, unfortunately, this is possible only infrequently; so I have answered my questions assuming that portable heaters will generally be used."

"Do not recommend any heater in theatres or moving picture parlours."

"Always connect to flue if possible."

"For schools, churches, theatres, offices, warehouses, and workrooms, permanent connections are preferred; and where intermittent use is necessary, heaters of the portable reflector type are best. We always attempt to finish the heater to match the fixtures. We prefer a flue and damper where it is possible to make it automatic."

"A clever idea used by one builder is this: On one side of the fireplace, which is adapted for wood, he has an electric wall outlet, and on the other side a gas plate—making it possible for the tenant to use wood, gas, or electric heater in the fireplace."

"Preferred practice is the use of stationary heaters connected with pipe. In most cases fireplaces are not available, and portable heaters are demanded."

"My choice of heater for a living-room is one of the illuminating flame type or a gas log; for bedroom, a portable heater of the reflector type; for theatres, stores, offices, warehouses, and workrooms, my choice would still be the reflector type, if it were well adapted for heating large areas; but I believe gas-steam radiators will occupy less space and give better results."

"While we sell a good many steam radiators, we do so because people want them, not because we think much of them."

"Where preference is shown for the gas-steam radiator, it is understood that improvements are needed on this type of heater."

"The radiator, round type, dead-black finish, sells best."

"For warehouses I consider a central plant desirable, preferably circulating water system. Surface combustion burners should be used. In all types of heaters, more care is required to insure correct proportional mixing of gas and air."

"The radiant-cone type is preferred by our consumers for bedrooms and living-rooms. Tubing is generally used, though we always recommend solid connections. Small round heaters are used in bath-rooms. We recommend gas logs for living-rooms, parlours, and sitting-rooms."

"If heaters are used only intermittently, and are odourless, if building code does not require a flue would instal none."

"The union connection for portable heaters is the ideal connection, but is not used to any extent; while slip-end connections, though the poorest, have preference over all other methods. I find that heaters connected solid stay in use; while a portable one with slip-end connection is set away and forgotten. From my experience, the automatically controlled gas-steam radiator is the most satisfactory for steady use, and the non-automatic type for intermittent use."

"DEMPSTER-TOOGOOD" CONTINUOUS AND "ELLAND" INTERMITTENT VERTICAL RETORTS.

The first installation of the "Dempster-Toogood" continuous vertical retorts at Hebden Bridge, by Messrs. Robert Dempster and Sons, Limited, of Elland, as described in the "Journal" for Oct. 7, 1913, was taken over by the Hebden Bridge and Mytholmroyd Gas Board in May last, and at the same time they gave an order for duplicating the installation, which is now nearing completion. The successful working of the Hebden Bridge plant secured for the firm the contract for a one million installation upon the same system for the Central Gas-Works of the Oldham Corporation. This plant, which is complete in every detail, we learn has been at work some eight weeks, and by it the whole of the gas is now being produced at these works. After inspecting the Hebden Bridge and Oldham installations, the Elland-cum-Greetland Gas Company have placed with Messrs. Robert Dempster and Sons, Limited, an order for a complete installation on similar lines; and this has since been followed by a contract for a similar installation for the new gas-works at Barrow-in-Furness. The firm, we learn, are also busy with the "Elland" intermittent vertical retorts. The Cleethorpes plant is now in its fifth year. The Singapore plant has already been put into operation; plants at Brisbane and Kilmarnock are nearing completion; and the Pontypridd contract is now well on the way. Messrs. Robert Dempster and Sons occupy the unique position of having evolved, patented, and built vertical retort installations on both the continuous and intermittent principles; and they are to be congratulated on their enterprise. We hope at an early date to give an illustrated description of the continuous installation they are erecting at Oldham.

Production of Nitrates from the Atmosphere.—At the meeting of the London Section of the Society of Chemical Industry on Monday of last week, Mr. E. Kilburn Scott, Assoc.M.Inst.C.E., read a paper upon the "Production of Nitrates from Air, with Special Reference to a New Electric Furnace." The furnace was a three-phase one, designed by the author, using the electric energy exactly as generated, and giving three arc flames within one wall. It was claimed by the author that a combined three-phase arc flame is hotter, and acts on more of the air, than three single-phase flames, each in separate furnaces; and he submitted that this, taken in conjunction with the other features of the design, rendered possible a yield considerably in excess of that obtained in Norway. He concluded by urging that the establishment of factories in this country to make nitric acid and ammonium and sodium nitrate from the air is a national duty, as they are required not only for making explosives, but for use in the aniline dye industry.

A GAS-FIRED FRIT CRUCIBLE FURNACE.

During the proceedings at a meeting of the English Ceramic Society, at Stoke-on-Trent, Mr. Singleton, of Messrs. Fletcher, Russell, and Co., of Warrington, gave some particulars of a gas-fired frit crucible furnace, built on the principle of a blast-furnace as usually employed for the continuous melting of soft metals such as aluminium.

Gas-Fired Frit Crucible Furnace.

It was pointed out by him that the difference between this and the ordinary metal-melting furnace is that the crucible is made with a bib at the bottom, so that when the frit is properly melted it can be drawn off in the same way that molten metal is drawn from a cupola. With this furnace, he said, they have no difficulty in getting a temperature of upwards of 3000° Fahr., which is equal to the melting-point of cone 29; and the furnace is specially designed for the melting of leadless glaze frits. It has the advantage that the whole of the materials are well fused by being kept in a body with the fluxes, so that there is no chance of the fluxes running away before the frit is properly melted. It is necessary to use a blast-furnace when high temperatures are wanted; but there is no reason why an ordinary crucible furnace should not be employed for the majority of the ordinary lead frits. The body of the furnace is constructed of the best material procurable for the purpose; and if it is occasionally faced with a mixture of fire-clay and silicate of soda, it will last for an indefinite period. In some instances, this casing is bound in cast iron to keep it together; and in other cases, for the purpose of preventing heat being lost by radiation, the outside has been lined with non-conducting material, such as slag wool.

As to its advantages, Mr. Singleton remarked that the furnace is self-setting, can be fixed at any point of a building, and takes up very little room. Moreover, it is a cheaper method, as coal gas compares very favourably with the price of solid fuel when used for this class of work. When once the furnace is heated, it can be kept going the whole day, drawing off the frit as it is melted, and recharging it from time to time. In this way, the furnace is kept at a fairly constant temperature; and with the use of a pyrometer it is possible to regulate the temperature so as to avoid a variation of more than 10° Fahr. during the whole of a working day.

GAS IN A MILITARY HOSPITAL.

The practical application of gas for meeting the urgent requirements of the War Office—both permanent and emergency—in the matter of cooking and heating, is effectively demonstrated by the accompanying photograph of gas appliances, made by Messrs. Arden Hill and Co., of Birmingham, with which the extensive Military Hospital at Cambridge has been fitted. The exigencies of the Military Authorities necessitated the work being completed in the shortest possible amount of time; and the Cambridge Gas Company are to be complimented on the successful manner in which they accomplished what was asked of them. The hospital, which has been erected temporarily, has been provided with Messrs. Arden Hill and Co.'s gas appliances for meeting all the requirements of a busy institution in cooking, milk sterilizing, tea making, &c.

Gas Apparatus in the Cambridge Military Hospital.

Value of the Modern Gas-Stove.—It was announced in the "Journal" a few weeks ago that Professor C. Vernon Boys, F.R.S., one of the Metropolitan Gas Referees, would deliver the Christmas lectures to young people at the Royal Institution, his subject being "Science in the Home." At the fourth of the series, delivered last Tuesday, he discoursed on "Heat in the Home," and expressed warm approval of the modern gas-stove as compared with its predecessors. He had a stove for demonstration purposes, and stated that half the heat produced by it had been measured to pass into the room as radiation and one-sixth from the metal work, while the remainder went up the chimney and kept a constant supply of air entering the room. The open fire, on the other hand, was not economical, as three-fourths or even seven-eighths of the heat from the coal went up the chimney. Towards the close of the fifth lecture, delivered last Thursday, Professor Boys dealt with the use of electricity for heating and cooking, and concluded with a reference to its cost as compared with gas for these purposes.

CONSTRUCTIONAL WORK IN GAS-WORKS.

By F. GORMAN, of Saltley (late of Buenos Aires).

[A Paper read before the Midland Junior Gas Association, Jan. 9.]

It is not my intention to discuss within the compass of this paper the relative advantages and disadvantages of any particular type of plant used in gas-works construction, but to endeavour, from my own experience, to bring out various points in construction which should be common to all plants. With this in view, I am hoping that my remarks, taken together with the discussion, may prove of advantage to all, and especially to the young engineer anxious to learn details, and how to get value for money.

The preparation of drawings should always be commenced well in front of the time when the actual construction is to take place, so that any detail can be fully discussed, and thereby bring one's past experience to bear on any particular point. Any rushing through of designs or specifications is fatal, and should be carefully avoided; for there is a possibility of a vital part being not sufficiently considered at the time, which will eventually show itself either in the construction or the working of the plant, with a consequent entailing of additional expense. The contractors asked to tender should be placed on an equal footing; and even if keen competition takes place among them, no jerry work should be allowed. Most contractors are above suspicion, and are as anxious to supply a good job as the buyer is to have it; but for all that careful supervision of their work is always necessary.

FOUNDATION WORK.

The clerk of works, before starting to map-out the ground, should check the measuring chain, theodolite, dumpy level, and straight edge; and his chief pegs should be driven well into the ground and protected with concrete. The pegs should be about 10 feet away from all excavation, set at a datum level and measured with a steel tape for being square, checked with angle measurement with the theodolite horizontal and vertical, all data booked, and a copy given to the contractor, who should sign both as being correct.

A convenient way to check any square is to remember the 47th proposition in Euclid—*i.e.*, the square on the base, *plus* the square on the perpendicular of a right-angled triangle, is equal to the square on the hypothenuse. Thus,

$a^2 + b^2 = c^2$, taking the figure in feet, yards, or chains.

Before proceeding with foundation work, I would here mention that, in my opinion, all drainage should be carried out before, or at any rate at the same time as, the foundations. This facilitates excavations and foundation work in general, and curtails all the unnecessary and objectionable cutting out of new work if left to be the last thing to be considered.

In foundation work there will invariably be noted on drawings a remark to the effect that the depth is to be settled on the site; and in deciding this depth, due regard must be had both to safety and economy. A sure and fast rule, such as "always seek a firm sand or gravel bottom," is good; but economy is often sacrificed by reaching a gravel bottom without much additional safety. In deciding this depth, it is purely a matter of experience. The young engineer who has not had the necessary experience would do well to take the advice of the ganger in charge of excavating; and if he combines this with his own common sense, the difficulty will be overcome.

Wet foundation work is always an evil; but unnecessary labour is very often employed to cope with the inrush of water. A sump hole should always be sunk, and, preferably, outside the foundation to be laid, until 2 or 3 feet below the level of the excavation intended. Keeping the level of water down in the sump hole will render the excavation sufficiently dry for working. If large quantities of water are encountered, I would suggest an ordinary cast-iron pipe sufficiently large for a boy to be lowered down—say, 30 inches diameter. It is far cheaper, and dispenses with extravagant timbering in case of bad ground. In certain situations it may not be practical to adopt this method, but the following experience is a typical bad example. In the sinking of a well hole for the inlet and outlet pipes of a gasholder, the strata of the ground were as in fig. 1.

At the 8-feet level it was impossible, owing to the fluid nature of the sand, to cut walls preparatory to foundation laying; and we had to resort to close piling. But even with this, a constant oozing between the boards made the excavating very difficult. In this instance a strong foundation was not required, as the weight to be carried was small. Fig. 2 gives a plan of the excavation before concreting, A being the highest point, and a steam pump at the sump hole.

Immediately upon reaching the required depth, 6-inches of dry bricks were first put on the bottom, and afterwards 1 ft. 6 in. of wet concrete was firmly pressed on the dry bricks. The timbers were left in except the struts, which were taken out after concreting the bottom and a wall all round. This made a sound job, and remained dry when I inspected it some four years later.

In wet situations, where there may happen to be some delay between the excavating and concreting, I would advise allowing the water to rise to its own level, and not to be constantly pumping out to keep the bottom dry. Let the water remain. It will act as a support for the sides; and it also avoids the possibility of making a well hole under the excavation.

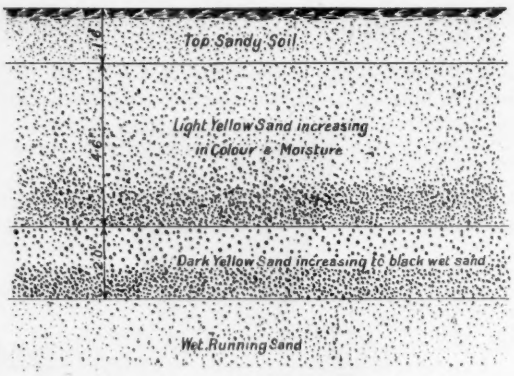

Top Sandy Soil
Light Yellow Sand increasing in Colour & Moisture
Dark Yellow Sand increasing to black wet sand
Wet Running Sand

Fig. 1.—An Example of Bad Ground.

When excavating large bodies of earth, get the carts right on top of the job, so that excavating and loading is done in the same operation; or, if the incline is too great for carts, adopt a Décauville system of light railway. This is laid on the top of the ground, and moved to any position according to the excavation. On a 2-feet gauge, waggons will take approximately 10 cwt. each time.

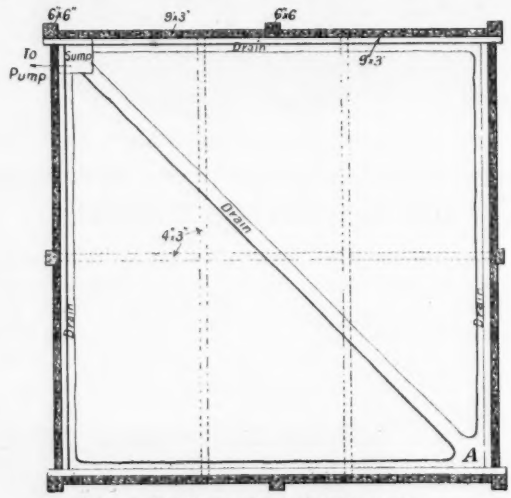


Fig. 2.—The Excavation before Concreting.

The staking out of levelling pegs should be done systematically, especially in large areas. Fig. 3 shows an arrangement I have used myself and found to answer very well.

In gas-works practice, I prefer putting in stakes with a straight edge after giving a starting point with a level from the theodolite, and occasionally checking as the work proceeds. Theodolite levelling is, of course, very accurate, providing the instrument is accurate and the leveller is accustomed to it; but as one is not constantly working this instrument in gas-works, its peculiarities are not soon recognized.

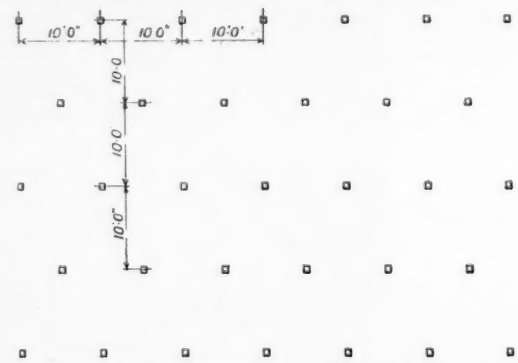


Fig. 3.—Staking-out Levelling Pegs.

In piled foundations, great care should be given to the selection of the piles. Timber piles should be straight-grained, and one should aim at getting the centre of the tree. Knots should be avoided, as these are often the cause of the pile breaking. I have found pitch pine very suitable, although woods such as teak, elm, oak, beech, greenheart, larch, &c., can be used. All the rough projections should be shaved off, and one end of the pile should be shaved down to approximately twice the width of one side, and

strengthened by a steel point. The head should be protected from splitting by having a band of mild steel about 2½ in. by ½ in. flat sweated-on and further secured by screws. The pile should always be kept perpendicular when driving; and any deviation from the perpendicular should be immediately checked. The tops of the piles, when down in position, should be braced together on top in such a manner as to answer the purpose for which they are intended—*i.e.*, to bring the whole weight of the structure on the piles and ignoring the supervening earth.

Before leaving the question of piled foundations, I would like to give a typical example of a half-piled foundation for a chimney. A retort-house chimney, 100 feet high, was required to be built upon one-half an old piled foundation which had existed for forty years or so, and half new ground with the strata giving water at 12 feet deep. The piles were driven down until the friction was able to withstand a blow of a 6 cwt. monkey, with a drop of 20 feet, without any alteration. Fig. 4 gives a section of the foundation as laid. I might add that no settlement took place.

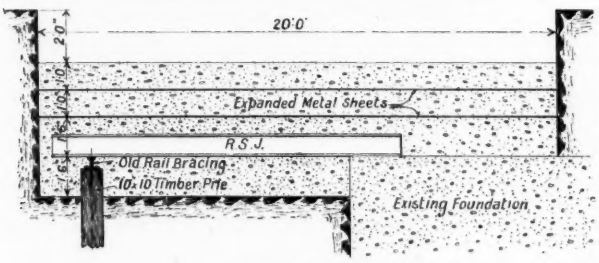


Fig. 4.—Section of a Foundation.

Concrete.

Concrete is a substance which cannot be bought in bulk to some particular standard; and as the materials comprising it have such a wide range of variation, I think that one should be especially careful in choosing them, and should not fail to reject any that is at fault. It must be remembered that good concrete cannot be made with bad materials.

The broken bricks should be of fairly uniform size, and able to pass through a 2-inch ring. If broken on a heap, they should be forked-up before using; the dust remaining (sometimes considerable) can be used, when mixed with sand, for mortar.

The sand has always been a subject of discussion. In my opinion, a sharp sand, somewhat gritty in nature, is preferable, not only on account of its greater adhesive properties, but also for being far easier to make a better mixture with cement; the voids between particles of sand being larger and more easily filled up on the mixing board. As a test, all sand should pass through a mesh of 400 per square inch, and be retained by one of 900 meshes per square inch. A thick close sand, such as I have seen used in various parts of the Midlands, should always be washed free from loam. Although this class of sand may be more impermeable to water if mixed properly, for the reasons given above the efficiency of the concrete is not so great. As a rough test, clean sand should leave no stain when rubbed between the fingers. River and sea sand should be avoided where possible—the former on account of its being rounded and polished, and the latter because of the presence of alkaline salts, which will eventually show themselves by efflorescence.

Portland cement is now supplied by manufacturers to the English specification; so that, providing the tests submitted are carried out in the right manner, one is safeguarded on this point. But great variation in the results of the tests can take place with precisely the same cement; and the mixing of the briquettes should be, I maintain, as near as possible upon the lines on which the cement is mixed in actual practice.

When dealing with concrete, it is a common thing to find engineers still referring to the proportions as 6 to 1, 8 to 1, &c. I would strongly advise everyone to avoid this, as it is most misleading. For instance, 6 to 1 can be 1 cement, 5 broken brick, and 1 sand, or 4 broken brick, 2 sand, and 1 cement, the difference in strength of which will be seen.

The proportions of concrete, where cement is used, vary according to the different ideas and for the situations intended. I will, however, set forth some proportions I have used myself, and which have never failed me: For ordinary foundation work, broken bricks 6, sand 2, cement 1. For concrete walls or wet situations, broken bricks 4, sand 1, cement 1. For ordinary foundation work 30 cubic feet of broken bricks, 10 cubic feet of sand, and 5 cubic feet of cement will make a cubic yard of concrete when laid, and will require 12 gallons of water. In ordinary practice, the quantity of water cannot be measured to a nicety; so I recommend that the concrete should be mixed with an error on the wet than on the dry side.

Great care should be exercised in mixing concrete, for its ultimate strength depends upon this—indeed, practically 90 per cent. of the faults found have been due to bad mixing. In hand mixing, a little system in the arrangement of the concrete gang will eventually turn out better and more economical work. Fig. 5 shows an arrangement I have used on large areas, such as gas-holder foundations.

A has control of the water, B to G are mixers [I would insist that they should always mix towards the concrete face and not from it, so that there is a continual movement of concrete towards its destination], H levels from the stakes, and with a little use of his shovel brings the concrete to a smooth finish. Mechanical concrete mixers are excellent machines on large jobs, and even small machines, hand driven, prove highly efficient, and save money in wages.

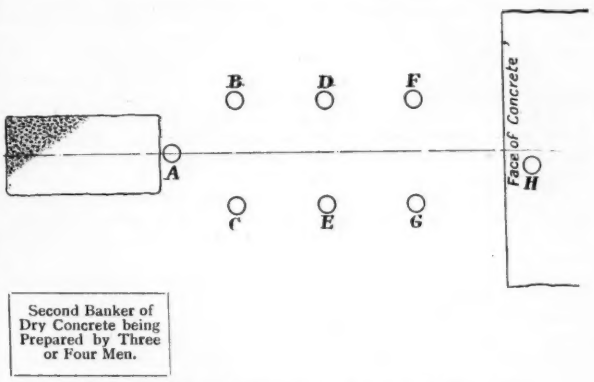


Fig. 5.—Method of Working for a Concrete Mixing Gang.

A mixer can be had so constructed that, when desired, it can be placed over a trench so as to discharge its contents into it. Being portable, it can readily be moved along as the work progresses, discharging each batch exactly where required. For this class of work this mixture will be found to be very economical, as no labour is required to place the concrete in position. For other situations, the number of men required are: One filling banker into barrow, one wheeling barrow, two turning the machine and regulating the water supply, one taking the bogie to the face of the concrete, and one levelling the concrete—making a total of six men per gang.

All concrete mixed should be used the same day, and not left overnight; and any cement concrete not set on its surface in twenty-four hours should be taken out and fresh put in. When knitting new concrete to old, a rough face should be made on the old and well washed with water. I would here remark that, in my opinion, a too liberal use of the pun is injurious to the concrete, as the bricks become further broken, leaving a dry space which may develop into a fault.

I have so far dealt with cement concrete. If lime should be used, great care should be taken that it is properly cooled before using; otherwise expansion will take place, to the detriment of the concrete.

It occasionally happens that the pressure of water on a finished foundation finds a weak spot, and any amount of patching will fail to put matters right. In such a case the following method has been used by me, and found satisfactory, where I was working 8 feet below the sea level. Cut out a portion large enough to secure a 1½ inch or 1 inch gas-tube, and pass the tube as far through the concrete as possible, knit round with cement, and leave the pipe open at the top for a vent. After a lapse of time sufficient to allow the new cement to set, plug-up the pipe.

How often it is that we see foundation work so entirely neglected, and one's total energy concentrated upon the structure these foundations have to carry. Yet any failure of structural plant can often be remedied; but a fault with foundation work may be the complete ruin of the whole plant.

We have heard of cases where settings and benchwork in the retort-house have been ruined through faulty foundations, and chimneys tilted to such an angle as to have to be taken down completely. I have a case in my mind where the retort-house roof had to be cut away to give more room for the chimney in its inclination. It therefore behoves everyone to pay more attention to foundation work than is usually the case; for one is always coming against some novel aspect which requires the exercise of no little ingenuity. The question of a few shillings or pounds should not be considered when deciding the class of materials to be used; and I cannot express myself too strongly that the efficient carrying out of foundation work is an all-important factor in any class of constructional work.

Brickwork.

The quality of bricks used in brickwork should always receive particular attention; for a well-designed building will often be spoilt by ignoring the quality of bricks used in its construction. All the bricks should be of uniform size and colour; for what is worse than to see a supposed red-brick building bespotted with a variety of colours. Sample bricks should be obtained from the contractors and broken to examine their texture, and one should see that all bricks sent in are in accordance with this sample. A good brick will have its edges at right angles, its surfaces parallel and not too smooth, and will give a very clear ringing sound when struck; when broken it should have close texture, be of uniform colour throughout, and not contain any stones, lumps, cracks, &c. A further test is to immerse the brick in water—its absorption of water should not be more than one-sixth of its own weight. The size of the brick should be noted; and although the ordinary stock brick will be 8¾ in. by 4¼ in. by 2¾ in., the chief thing to note is that the length should exceed twice the breadth by the

thickness of a mortar joint. We are fortunate in this country to be able to obtain bricks with so slight variation of size; for in other countries I have seen "first-class" bricks vary from 9 to 11 inches in length, 3½ to 5 inches in width, and 1½ to 2½ inches in thickness—and all in the same truck.

The colour of bricks to be used is a matter of opinion. I have found plum colour suitable for gas-works practice. This colour harmonizes very well with blue bricks—should one have blue-brick string-courses, arches, and sills.

The question of bond is, of course, connected with the design; but old English bond is common practice. It is strong, and presents a good appearance. In glazed brickwork, I would certainly recommend the adoption of Flemish bond.

The joints of the brickwork should be kept an even thickness; and if a building is being erected by contract, one should see that he is paying for bricks and not for mortar. With the ordinary stock brick built in cement, ⅜ inch is ample to allow for the joints; and this may be reduced to ¼ inch in thickness when using lime mortar. One method of keeping even joints is to erect a straight-edge vertically at the quoin brick, and mark on it the courses and joints as a gauge. This system is in vogue in some Continental towns; and I have myself adopted it in construction outside England.

Before leaving joints, I would mention the advisability, in the case of lintel arches, to put in the key brick to brick, and especially so where any considerable weight is brought upon it. A typical example is the floor of a coke-oven, which has to carry the weight of the whole of the charge—say, 10 tons—and where any sliding on the joint would cause the floor to sink.

The engineer will have to decide whether to use lime or cement mortar, and will be faced, on the one hand, with a cheaper and weaker joint, or a more costly and certainly stronger joint in cement. There are cases where lime is preferable. To these I will allude later. Generally the difference in cost will be, volume for volume, as 1 is to 2; and though it is not necessary to make the joint as strong as the brick, it must be remembered that the strength of the brickwork is the strength of the mortar.

Again, cement mortar has not the elasticity of lime; and for chimney work lime is preferable on account of this, though I have known engineers who prefer strengthening the lime slightly by the addition of a little cement. If an engineer sacrifices some slight strength for the sake of economy, and employs lime, I would recommend using the proportions, 1 lime and 2 sand. As there is a danger of lime being air-slaked, when bought in a ground condition, the purchase of stone lime is advisable; care being taken to thoroughly remove all lumps, &c., after being slaked.

Blue lias lime is the quality ordinarily used in the Midlands, and contains approximately 75 to 80 per cent. of lime carbonate, 15 to 17 per cent. of silica and alumina, and a little water. When mixing with sand, the same remarks apply as to concrete mixing—*i.e.*, aim at filling-up all the voids between the particles of sand. When using cement, 3 parts sand and 1 part cement is a proportion I have myself employed with success, though in some cases this might be reduced more to the theoretical mixture—4½ parts sand and 1 part cement. Some prefer to add a little lime, to prevent it from working short. This will, of course, weaken the mortar, and should not be indulged in to any great extent. But whether using lime or cement mortar, it must be remembered that the formation of silicates commenced in the kilns is continued in the presence of moisture, and a little water also combines itself forming hydrated compounds which set by crystallization; and so the setting action is stopped if allowed to dry too quickly. All bricks, therefore, should be well soaked with water before being laid; for this will also remove all dust, and help the adherence of the mortar.

In laying bricks, all should be buttered well, and grouting only allowed where this is impossible; and one should be especially careful not to allow any part of a wall to rise more than 3 feet above another, so that all weight is equally spread and not concentrated at any one point. Much labour is often wasted in timbering for arches under floors. Fig. 6 shows a method I have adopted considerably, in order to avoid the constant propping-up of centres. It is cheaper, and leaves a key for plastering, if so desired.

Fig. 6.—Method of Arching under Floors.

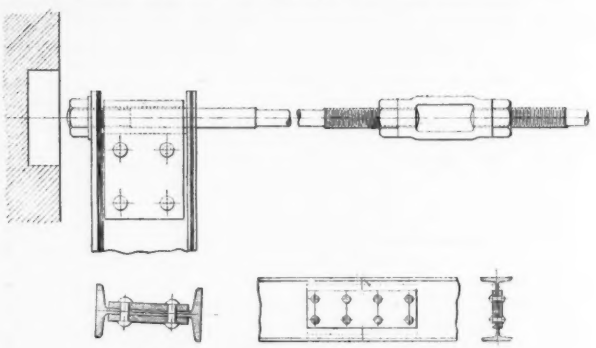
A bar of flat about 2½ in. by ½ in. is curved to the radius required, with the ends straightened, and loose boards placed on top. Concrete or brick filling, as is desired, can then be proceeded with; and when needed to be removed, the bar will fall out, if struck at each end. For arches in walls over doorways or windows, the timber centre is, of course, preferable; and in this case, one should be careful to see to the correct adjustment of the centre, so that the haunches of the arch entirely spring from the abutment.

I have very often seen damp-proof courses entirely forgotten. These should be laid some two or three courses above outside ground level; and two courses of slates laid in cement mortar will be found to be very efficient. This is considered to be the general practice. It will be noticed in some parts of the country that new buildings are somewhat defaced with a white efflorescence, or, as it is commonly called, saltpetreing. This sometimes points to a lack of interest on the part of the man responsible through accepting bad material—bricks or mortar. The sulphur from neighbouring chimneys, or from coal when burning bricks or limestone, converts the magnesia or lime in the bricks or mortar into sulphates. When bricks are wet, these dissolve, only to reappear when dry by evaporating and leaving the crystals on the surface. Formation of chlorides is nearly sure to take place if sea sand is used, or if bricks are made from clay which has been covered with salt water. Prevention is better than cure, and any limestone containing magnesia to any great extent should be avoided, as this is acted upon by sulphur during calcination. It is difficult to take this off the face of the brickwork permanently, though if washed over with fine sand or water this will help to fill the pores; and painting will stop the efflorescence, if it has not already started forming. This, however, is only making the best of a bad job.

Steel Structural Work.

The quality of materials used in steel structural work is, of course, just as important as in building or foundation work; but as this has already been discussed before the Association, and is also outside the scope of my paper, I wish only to point out various defects which often take place in the carrying out of the construction.

A steel structure may be perfectly designed in every way, and properly proportioned in all its parts; and yet the efficiencies which have been so carefully worked out may be wholly destroyed in its actual construction. The adoption of slotted holes in a bolted structure will greatly facilitate the work of erection, especially the plumbing-up of stanchions and squaring-up the structure, and will save objectionable cutting of holes. Where the stress on the structure is dependable upon the shear of the rivets, advantage should be taken to bring the sections into compression where possible; for very often circumstances will occur which do not present themselves to the designer, but which bring the shear on the bolt or rivet, as the case may be, to its ultimate strength. This may be exemplified where the erector has happened to run out of the size of bolt or rivet he requires, and, in order to save time and trouble, puts in a smaller diameter.



Figs. 7 & 8.—Examples of Bolting and Riveting.

A typical example is fig. 7, showing the end buckstay of a retort-bench or boiler-setting. Fig. 8 shows another example, where two girders or rails are fishplated together. The straps or fish-plates, if extended in width until they touch the sides of the flange of the section, relieve the shear on the bolts. This fault is not uncommon, and can often be seen in general practice. Joint plates, if properly bedded on the section they join together, increase the shearing resistance of the rivets by the friction; and where two or more plates are riveted together, the whole of the surfaces should be in contact. Surprising efficiency is shown by tests made to ascertain this; and in cases the friction has more than compensated the loss due to the punching of plates, and made the metal between holes stronger than the solid plate.

With regard to expansion, proper provision is, of course, made in the design, special provision being made for retort-bench work. But how often do we see examples where all due care has been taken with the cast iron or mild steel floor-plates of the retort-house floor, and yet the longitudinal floor joists have been bolted-up direct to the end stanchions? In fig. 7 you will see an instance where the wall of the retort-house is so close to the tie-rod nut as to necessitate a pocket being cut out of the wall. This pocket has been an afterthought forced by circumstances, in more than one case I have in my mind. One point should be remembered—that all tension-rods of settings should be tightened-up by hand, and not with a spanner, before the retorts are in full working order, or at least on full fire; for expansion will always more or less take place, and the rods should be at rest when this happens, and not be already in tension.

The great weakness in the erection of all steel structures is the riveted or bolted work; and it is here that the engineer should be most careful and reject any work which he considers not a good job. So much of the work depends on the class of labour employed on the job, and the reputation of the firm executing it, that it behoves the clerk of works to be especially cautious and make careful examination of all rivets or bolts put into the

structure, and to see that the sizes and thicknesses of plates, girders, columns, &c., are to the drawings and specifications; for many fractures have been found afterwards to be due to some "cheeseparing" on the part of the contractor. All faults found should be mentioned to the chief engineer, who will be only too thankful to have such work brought to his notice.

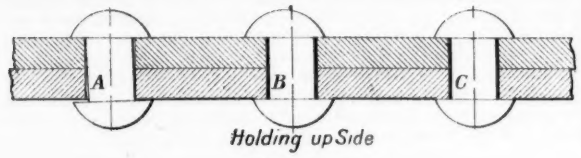


Fig. 9.

Fig. 9 shows a few forms of riveted work. A is the shank of the rivet exposed, and is due to bad holding-up. This will be chiefly seen in cold riveting, such as gasholder sheeting. B shows bad snapping, thereby throwing the centres of the heads out of line. Such work can be noticed by the difference in the pitch of the heads. C is a well-snapped rivet.

Fig. 10 is an illustration of what is done when the shank of the rivet has been too short, and a groove is cut all round the head with the snapping tool; and moreover there is no assurance of the rivet being tight owing to this lack of rivet shank to receive the pressure and thereby allow the snaps to enter the plate. Illustration A shows the effect when more than sufficient metal is left in the shank, thereby causing a ring all round the rivet head.

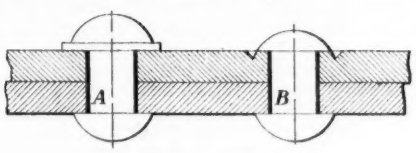


Fig. 10.

Although objected to by some engineers from the point of looks alone, I would far sooner have rivet shanks too long than too short; for in this case the plate will not be indented during the squeezing-up, and one is assured that the rivet has received all the available pressure of the machine, and is therefore tight. In my opinion, this is a sound job, and should not be rejected. In hot riveting, all rivets should be hot throughout when inserted, and cold or burnt rivets should be rejected—cold rivets owing to their heads being split when snapped-up, and burnt rivets due to their heads being badly pitted, and therefore a bad fault for gas-works practice.

When bolting plates to rolled-steel joists, the use of taper washers is a great advantage, in order to take-up the taper of the flanges of the joist. In all structures when assembling, holes will be found that do not come into line, and are more or less blind to each other. They may have all been drilled or punched to a template in the shops; but there is the tendency to grow, owing to the difference in temperature when being built. This is most marked when the difference of temperature is great, such as when erected in warm climates, together with great variation in the thicknesses of the sections, and particularly in the case of large surfaces, such as plate work, which fasten up to compact strong sections, such as joists, which have little surface area. The usual method is to drive a drift through, thereby stretching the metal and elongating the hole sufficiently large to pass the rivet.

Drifting is bad practice, and should not be indulged in; for the hole is entirely distorted and causes weakness in the plate round the particular spot. This will be especially noticed in large plate work, such as holders or steel tanks. In large areas of riveting, the growing will be stopped by occasionally having an undrilled plate, which will be drilled in position, and so gives a new starting point. Very often, of course, it is caused by mixing up the plates owing to the erection numbers having been rubbed off, or to the templates not being standardized and interchangeable.

As to the method of riveting, I prefer hydraulic work where it is possible to be used; for with the use of the machine, the various thicknesses of plates at the joints can be closely pressed together, and so bring all parts in close contact, with the great advantage of utilizing their frictional resistance.

Bolted work in structures is very often convenient from the contractor's point of view—being the quickest method of fastening and easily removable. From the purchaser's point of view, however, although a bolted job can be made successfully, it requires a lot of after-care, more particularly if the structure is subject to vibration. In this case, it is better to have little longer bolts, and hammer them over to ensure that the nuts will not come away. The chief points to be noted are that the lengths and diameters are long and large enough.

Fig. 11 shows right and wrong methods of bolted work. A having the pin too long, and besides being unsightly, it will be found a great inconvenience where the work will be subjected to any heat. The wasting of the thread will be an endless source of trouble when dismantling.

I would here say that, where possible, bolted work should never be used where extreme heat is likely to be brought upon it.

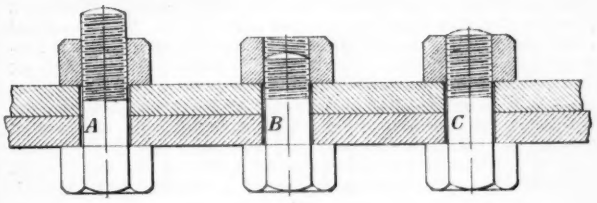


Fig. 11.

One should also see that the holes through which the bolts pass are not more than $\frac{1}{16}$-inch larger than the diameter of the bolt, except where slotted holes are used, as previously described.

The question of punched or drilled work is one of design, but gives rise to a few difficulties with which one has to contend in practice. When drilling a hole, there is caused a fray or wire edge around it, which is sufficient to prevent the proper bedding of joint plates. It is also a point of weakness in itself, and the shear of the rivet will be increased by removing this fray and slightly countersinking the hole. A punched hole, being a taper hole, and the thicker the plate the bigger the taper, causes trouble and risk of tearing of sections and plates if ever they have to be dismantled.

Fig. 12 shows the effect of riveting three sections together. It illustrates how a shoulder is formed upon the rivet shank. This is a most unsatisfactory position of affairs; and if at any time

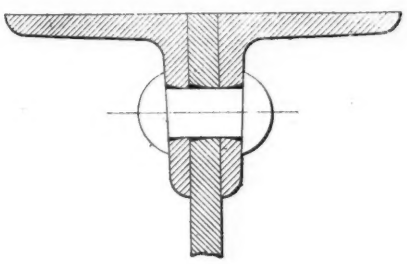


Fig. 12.

one desired to renew the angle sections of a built-up girder, in drifting-out a shouldered rivet the girder plate would be disfigured, and the plate between the hole and the outer edge is liable to be torn.

Generally, punched work may be safely carried out in plates up to $\frac{1}{2}$ inch thick, punched and rimered $\frac{1}{2}$ inch to $\frac{3}{4}$ inch, and all above $\frac{3}{4}$ inch drilled. In large structures, however, where some of the plates are $\frac{3}{8}$ inch and perhaps $\frac{7}{16}$ inch thick, why have a variation of perforating plates? Why not have all plates to be specified to be drilled and rounded, and so save the endless trouble of having punches and dies in bad condition tearing away the sections?

"Costing" Work.

In conclusion, I would recommend that when new plant is being erected a proper and efficient costing system should be adopted. Such system should be simple and practical in its form; and the engineer when devising it should bear in mind that the knowledge of the costs of a job is more beneficial during the progress of the work than at its completion, and that such dissection should correspond with the dissection as framed in the estimate. In most works, revenue charges are properly dissected, to enable the engineer to place his finger upon any weak spot; these returns being available each week or two weeks, as the case may be. A similar dissection should be done in capital work, with returns available for similar periods, so as to facilitate a better supervision and detection of any section or gang of workmen who are not carrying out their duties in the manner upon which the estimates were based. Satisfaction is thereby accorded to the gas engineer of knowing that the carrying out of the constructional work to his designs has been in the most economical and efficient manner.

DISCUSSION.

The President (Mr. F. J. Ward, of Knowle) said he was sure it would be the wish of all the members that he should heartily congratulate Mr. Gorman on the important appointment he had just secured as Works Superintendent to the South Suburban Gas Company. This new position was one which afforded great possibilities; and there was no doubt that he had a successful future before him. Mr. Gorman had stuck to the Association all through, retaining his membership even during the years when he was abroad; and they were grateful to him for the interest he had always taken in its affairs.

Mr. A. O. Jones remarked that the paper dealt with a very big subject; and most of the sections of it could be considerably enlarged. It was a true statement, that the young engineer who had not had the necessary experience would do well to take the advice of the ganger in charge of excavating. Many things were to be learnt from the ganger which were not to be found in books. Wooden piles should be used only in situations where they were likely to be continually saturated with water. In places near

tidal rivers, they should be below low-water mark. If wooden piles got dry, they were apt to rot in a few years. When exposed to salt water, they should, of course, be creosoted; otherwise sea-worms destroyed them in three or four years. As regarded pit and river sand, it seemed that the former, being more gritty, was the better material; but he thought the difference between the two was probably over-rated. The fact that one used round pebbles in concrete appeared to show that this contour was equally good, in regard to strength, as more angular ingredients. Probably the point was that the material was bad when smooth and shiny, not when it was round. Sea sand was very cheap, when one was near the shore; and the thing was not so much to avoid it as to see that it was properly washed free from salt with fresh water. With reference to the proportions for cement, he did not think the definition 6 to 1, 8 to 1, &c., was greatly improved by further division. If the proportions were stated as 1 cement, 2 sand, and 4 broken brick, it did not necessarily follow that one was getting a good idea of the strength of the cement, because so much depended upon the mixing. When stating the amount of sand, mention ought also to be made of the size of the aggregate—the proportion of fine and large. The proportion of cement given in the paper for ordinary foundation work seemed rather large; for 5 cubic feet of cement worked out to about two bags of cement per cubic yard, while, in his opinion, for ordinary purposes one bag was quite sufficient. Mr. Gorman recommended that concrete should be mixed with an error on the wet rather than on the dry side. Sufficient water should be added to make it plastic; but beyond this point, the strength was apt to be reduced too much. It was certainly true that most of the faults of concrete making were due to bad mixing. When mixing, sometimes the platform was slightly inclined towards the delivery end. Some engineers went so far, with regard to mixers, as to say that they found them better than hand work. They certainly eliminated the human element of error, which everyone had heard so much about. He would like to know Mr. Gorman's experience on the point. Ramming concrete while being laid, of course, consolidated the mixture, and made it stronger; but too much ramming was bad, because it brought grout to the surface, and the result was an imperfect mixture. One thing not mentioned was the use of displacers in concrete—commonly known as "plums." These were large stones put in the middle of the concrete. When it was of any depth, this could safely be done, he thought, up to about 20 per cent., without reduction of strength, and with a saving of round about 15 per cent. in cost, which was not to be ignored in foundation work. He would not recommend it for work in tension; but for compression it was a good thing. With reference to efflorescence, he had found more of this where chemical cement had been used than with ordinary portland cement, but did not know if the fact could be explained. He had recently had under his supervision a pneumatic riveting plant, which was very useful for field work. It had the advantage over a hydraulic machine that the parts were lighter and more portable. The pipe-line was easily connected; and the leakage was not so troublesome. There were a great many points in the paper which would be helpful to anyone having extension work to carry out.

Mr. C. F. W. RENDLE (Redditch) said that, with regard to concrete proportions, there was often a doubt in the minds of the men as to just what 6 to 1 or 8 to 1 meant; and it was much better to state the constituent parts more definitely, as the author had indicated. In recommending the forking of broken brick, did not this depend entirely on the nature of the brick? There were some bricks of which the dust was equally as good as sharp sand, and could be well left in. He had often found this to be the case. Did not machine mixing almost entirely supersede hand mixing? With gangers, one required constant supervision to see that the material was thoroughly wetted. Even good men were apt to let concrete go through in which a large proportion was free from water. All this was done away with by a machine mixer. Was the pun really of any use at all, if the concrete was tipped from even a moderate height? With only a little punning, the grout came to the surface. In the construction of a gasholder tank, he had found it advisable to dispense with punning altogether. A drop from the skip of about 2 feet gave quite a good result. It was an advantage to have concrete rather on the wet than on the dry side; but with a machine mixer, there was no need for it to be either.

Mr. J. H. MORRIS (Saltley) pointed out that, in the matter of concrete mixing, much depended upon the size of the job. The first question to settle was whether the job justified the employment of a machine; and the second one was, Did it save any labour? With a hand machine, there were two men to turn it, a couple more at the very least to feed it; and then somebody was needed to serve up. Then, was it so reliable? Could one be assured that the mixing was as thorough as when done by hand? In the latter part of the paper, dealing with structural work, the author had pointed out certain defects which, of course, were known to occur, in connection with riveted and bolted work. They were defects of workmanship alone; but it was not pointed out what loss of strength resulted to the structure from such bad work. Undoubtedly, what the speaker desired them to grasp was that with bad riveting they lost the advantage of the strength obtainable by friction between the sections when having been drawn close up tight to one another. Punched work was not so strong as drilled work, owing to the section round about the surface of the hole being somewhat crystallized by the effect of the blow from the punch. But this loss in the section could more or less be made good, if advantage was taken of the strength obtainable from the friction of the plates, which, when added to the lesser strength of the punched plate, as against the drilled plate, would give it an increased value. Generally one found in steel stanchion work, where the stress was in compression, the whole of the load unfortunately came upon the shear of rivets, instead of taking advantage of the various sections which comprised the stanchions being brought down upon the base or foot plate, in order to obtain the whole compressive strength of the sections previous to the shearing action coming into force. This was illustrated, again, in built-up girder work, where one often found the stiffeners were shortened, in place of being brought up right under the top plates, in order that they could be under compression, instead of merely on the shear of rivets. The strength of rivets varied a lot. There was much fuss made when engineers specified drilled work throughout. If there happened to be any quantity of plate-work in the job, he did not think there would be found very much difference in the cost, because most of the large contractors had set themselves out for drilling. For ½-inch plates, it was as cheap to drill as it was to punch. One could only punch a single plate at a time, whereas four or five sections could be drilled together. He would like to ask Mr. Jones what his pressure was for pneumatic riveting.

Mr. JONES: About 250 lbs.

Mr. MORRIS: Do you consider it has general advantages over hydraulic riveting, or is it merely a question of convenience in particular circumstances?

Mr. JONES: As a portable machine, the pneumatic riveter is the more convenient. That is for field work; I do not mean in the yard.

Mr. MORRIS replied that the experience in shops was that pneumatic work was not good. One could not rely upon it. Hydraulic work was best, because of the pressures obtainable, and the advantages one secured if working three or four sections at the same time. The action in pneumatic riveting was very sudden.

Mr. RENDLE remarked that he could state definitely that at least one large firm of gasholder makers wanted more money for drilled than for punched plates.

Mr. MORRIS pointed out that he had been speaking about plates of a thickness of ½ inch, and more.

Mr. JONES interjected that he thought no one believed in punching over ½ inch.

Mr. S. MESSENGER (Saltley) said that personally he had never had any experience of machine mixed concrete. He had recently had the control of putting down a few thousand yards of concrete, all hand-made. It had been put down very well; and there had been no subsidence or settlement. In fact, there had not been a single fault found with it. One point Mr. Gorman had referred to was that of dust. In their own case, they broke up all the bricks with a stone-breaker; and underneath the breaker they put a sieve. All the dust collected from the breaker they used in the concrete. He had made a great number of tests of concrete; and he quite agreed that the proper way to carry out a test was that the man who had to use the material should do it. The right way to test was, in his opinion, to go down to the works, and, if a bricklayer was at work, take a dab from him and test it. By this means, one could get a much better idea of the material than by taking a sample of the cement and trying to make the best one could of it. With the tests they had made, they had found more than 25 per cent. difference.

Mr. R. RAMSDEN (Smethwick) asked, with reference to the elongation of sections, whether the author had had any experience of diagonal ties of gasholders 28 or 30 feet long, the holes of which, owing to variations in temperature, were not in line, resulting in them requiring slotting. He had seen a fair amount of concrete used round about the district, and some people had not taken the trouble to wash the sand.

The PRESIDENT, in proposing a hearty vote of thanks to the author, both for the paper and for an excellent series of lantern slides which he had exhibited showing gas-works construction in South America, said he could not quite agree with the remark that a sump-hole in wet foundation work should always be sunk, and preferably outside the foundation to be laid; and that keeping the level of water down in the sump-hole would maintain the excavation sufficiently dry for working. This was not his own experience when building a gasholder tank some few years ago. It was in a subsoil where one could sink a sump-hole in a certain position, and within 6 feet another one could be sunk, and one would be completely dry, and the other would be full. They had very great difficulty in keeping water-free; but owing to the nature of the soil, they were able to run small drains from the outside to the inside, and so overcome the trouble by drawing all the water to a central point. In certain soils, of course, one could draw all the water to a single sump-hole. With regard to the example given of a piled foundation for a chimney (which was partly on an old foundation), he should hesitate before putting rolled steel joists under water. If these joists were in water, he should fancy that in the course of years the oxygen would have an effect, and probably cause decay, with disastrous results—one part of the foundation being solid, and the other not. He quite agreed with putting in good foundations for chimneys. At his own works, he had a chimney which was erected a good many years ago; and the engineer did not specify a sufficiently wide foundation. Recently he wished to somewhat raise the height of the chimney; but unless he strengthened the foundation (which

would have been impossible without pulling down part of the retort-house), he could add only half as much as he wanted to the chimney. At present, in a good gale, it rocked rather more than he cared to see. Though it was only about 50 feet high, it rocked some 6 inches. The author said that, when using cement, 3 parts of sand and 1 part of cement was a proportion he had employed with success, though in some cases this might be reduced more to the theoretical mixture of 4½ parts of sand to 1 part of cement. How did he arrive at the theoretical mixture? He (the speaker) had never been able to discover it in any text-book. The method illustrated of arching under floors seemed very simple and very satisfactory. He did not quite agree that all tension-rods in settings should be tightened-up only by hand. To his mind, they required something more than this. Mr. Gorman deserved their very best thanks.

Mr. H. E. Stone (Nechells), in seconding the vote, remarked that Mr. Gorman had referred to a 30 inch pipe for a sump-hole sufficiently large for a boy to be lowered down. How did he manage this? Slotted holes for bolted-up work did not seem to him to be very good policy. He thought that where possible work should be specified to be drilled, not punched—at any rate if it contained any thick plate. For gasholder work with very thin plates, it did not matter so much. Particularly when punches got worn, holes made with them were not so true as drilled ones; and this should be borne in mind.

Mr. Gorman, after thanking the President for the congratulatory remarks he had made on his new appointment, proceeded to reply to the various points raised in the discussion. He said he quite agreed with Mr. Jones's remarks as to wooden piles in sea water, and always made a point of creosoting them; but there were occasions when with sea water it was preferable to use reinforced concrete piles, which would be found better than creosoted timber. It did not seem to him (the speaker) to matter whether pit sand or river sand was used for cement, except from the point of view of sharpness. The great thing was to get a sharp sand, which would give strength. To state merely that the proportions for concrete were to be (say) 6 to 1, was confusing to the man who was on the works, and did not really know what it was going to be. The proportions should be more definitely named. No doubt all were agreed that hand riveting was not nearly so good as machine work; and the question arose as to whether to use pneumatic or hydraulic plant. With the former, of course, one had a certain pressure to start with, and a maximum at the finish; whereas with the hydraulic machine the pressure could be regulated at will. It might be worked from (say) 700 lbs. to 1500 lbs. per square inch. Pneumatic riveting possessed an advantage on the score of leakage; but it was rather noisy, and in some localities this was objected to. As to the use of broken bricks, the great thing, of course, in forking-up bricks was not to get dust, so that there should be no fear of the proper proportions being interfered with. Machine concrete mixers were no doubt better than any hand mixing, as more equal mixing was secured. As to the cost for labour, hand mixing came out approximately at 2½ cubic yards per day for a man. If he failed to get this work, he would consider there was some laxity. He had mentioned a small hand-machine mixer, which was very useful, as with it one could turn out better concrete at one-half the cost. Instead of 2½ cubic yards, one got 5 cubic yards; and the gain of this extra 2½ yards would pay the cost of the machine in a very short time. The price of the machine was £30 delivered, so it was not expensive. It did not require a large amount of concrete work to pay the cost of the machine, if one could get double the work out of it. He agreed that punning might be disregarded. There was the danger with it of breaking-up the bricks again. Mr. Morris had referred to frictional resistance. This was a great point. With a really good frictional resistance, one could get the tensile strength of the metal in punched work increased to its original amount, owing to the damage to the fibres of the metal by punching being thus overcome. He had also emphasized other important matters. The question of drilled or punched work was a very old one. It was a fact that there were firms now who were laying themselves out for drilling; and they could turn out work as cheaply as, or cheaper than, punched work. All would agree that it was better than punched work; the only doubtful point had been that of cost. He had been carrying out tests of cement, and he might at some future time place them before the Association. He had noticed a difference of something like 25 per cent. between a briquette prepared as in ordinary works practice and one prepared by a contractor. As to Mr. Ramsden's remarks, stretching of holes occurred in many structures—especially where there were long lengths of ties. In these cases, rather than stretch the holes, it was better, when possible, to do the drilling on the site. Replying to the question of steel joists and water, to which the President had called attention, as a rule such joists were not put under water; but in the instance referred to they were painted before putting down and well covered with cement, so that they were not attacked. As to the theoretical mixture, a cubic yard of average sand contained 6 cubic feet of voids, which must be filled up by the cement, thereby giving proportions of 6 to 27, or 1 to 4½. This was the theoretical mixture, which was the point to be aimed at. As regarded the 30-inch pipe, Mr. Stone did not think that a boy could work in this. He certainly could; and in many cases it had proved an extremely economical method. The boy took out sand and put it in a bucket; and as the sand was removed from underneath it, the pipe sank down by its own weight.

CONTROLLING THE CALORIFIC VALUE OF MIXED GAS.

The number of the "Gas Record" for the 23rd ult. contains an article by Mr. C. M. Willis, the Superintendent of the Hartford (Conn.) City Gaslight Company, in which he shows how accurately the thermal standard of mixed coal and water gas is maintained in the city. The following are the principal portions of the article.

Since the new one million cubic feet vertical coal-gas plant was put into operation at Hartford, daily calorimeter tests have been made, and the heating value of the distributed gas has been maintained as near to a predetermined average as was possible when simultaneously working under a candle-power standard.

The coal gas and water gas are made and purified in two entirely separate systems of apparatus, up to and including their measurement in different station meters. The desired heating value is closely adhered to by varying the richness of the water gas as the quantity of this gas added to the approximately constant volume of coal gas is changed to compensate for fluctuations in the send-out. The proportion in which the gases are mixed can be controlled with great accuracy.

The daily tests during four months' operation of the plant have proved that, with proper facilities and reasonably careful operation, the average heating value can be safely maintained within 5 per cent. deviation during any three consecutive days, and the monthly average can be held within 1 per cent. of the desired figure. In fact, during three months, at no time have the calorimeter tests showed a heating value of more than 5 per cent. under the desired average; and in only one case did a test show a value more than 5 per cent. above, and then only 7·9 per cent. for not more than twelve hours.

In the Hartford plant the coal gas passes directly from the coal-gas station meter through a 20-inch main to the 2 million cubic feet storage holder. The water gas is pumped from the 280,000 cubic feet relief holder through the purifiers to the water-gas station meter, and thence to a header main which is connected through valves to each of two 500,000 cubic feet water-gas storage holders. A special exhauster in the meter-room pumps water gas from the header main and delivers it into the 20-inch main through which the coal gas passes. The two kinds of gas are mixed in this line, which is about 200 feet long, and pass together into the large storage holder. The quantity of coal gas passing into the mixture is indicated at all times by the coal-gas station meter, while the amount of water gas entering the mixture is controlled by the special exhauster, the rate of which is shown by an indicating speedometer (tachometer).

Calorimeter tests of the heating values of the coal gas, the water gas, and the mixed gas are made twice daily—in the early morning and late afternoon. For the coal gas and water gas the averages of the two tests are taken as the daily average values of each. The mixed gas daily average is figured from the late afternoon test and the next morning's test, in order to allow for the time required for the mixed gas to enter and leave the large storage holder and reach the point in the distribution system at which the mixed gas is tested.

Assuming it is desired to maintain an average heating value of 550 B.Th.U. in the mixed gas, and that the coal gas will have 600 B.Th.U. as its heating value, and the send-out on a given day will be about two-and-a-half times the coal gas output for the day, then the coal gas will make up about 40 per cent. of the total amount of gas mixed, provided the stock of mixed gas in the large holder is the same at the end of the day as at the beginning. The 60 per cent. of water gas consequently must have a heating value equal to

$$\frac{550 - (600 \times 0{\cdot}4)}{0{\cdot}6}$$

or about 517 B.Th.U. In actual practice, unenriched water gas (blue gas) is found to have a heating value of about 310 B.Th.U. per cubic foot. Experience in Hartford and at other places has shown that for each gallon of oil used per 1000 cubic feet the water gas is enriched about 78 B.Th.U. It follows that in the previously assumed case the heating value to be made up with oil is equal to 517 − 310, or about 207 B.Th.U., which divided by 78 shows that 2·66 gallons of oil per 1000 cubic feet are needed to produce water gas having a heating value of 517 B.Th.U.

It is not possible to estimate beforehand the amount of gas that will be sent out each day. By comparing the amount sent out up to a certain hour with that delivered during the corresponding period of the previous day, a sufficiently close guess of the send-out can be made to gauge approximately the proportion of water gas required to maintain the desired mixed gas stock. The use of curves plotted from the daily figures is the most satisfactory way to keep a close check on quantity and quality. [The author gave a chart recording daily averages and values of gas supplied by his Company.]

Having adjusted the oil per 1000 cubic feet to suit the volumetric proportions in which the gas is being mixed, it is desirable to check them hourly to ensure the continuation of the uniform mixture. The amount of oil used has to be changed when there is a variation in the rate of manufacture or quality of the coal gas, or when there is a change in the rate at which the gas is being distributed or sent out.

SCRAPING A FIFTEEN-INCH TRUNK MAIN AT BATLEY.

By J. C. Barrowclough, Water-Works Engineer.

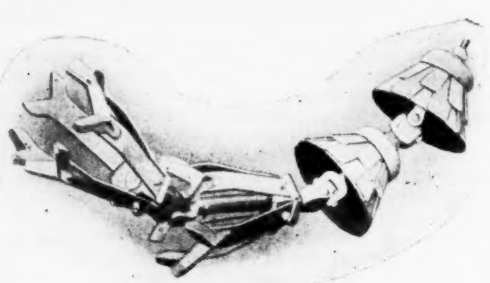
[**Extracts from a Paper read before the Institution of Water Engineers, Dec. 12.**]

The Batley Corporation Water-Works consist of three impounding reservoirs situate on the eastern slope of the Pennine chain near Holmfirth, about 17 miles of 15-inch trunk main, and a covered service reservoir at Staincliffe, within the borough of Batley. The water is obtained from moorland pastures and springs from the millstone grit; and being of excellent quality, and, having only 2° of hardness, is exceptionally well suited for dyeing, scouring, &c., in the heavy woollen industry carried on in the borough. There is no filtration or other treatment of the water, except a system of automatic flood-gates, which divert the acid water washed from the peat, particularly after a drought, into the lower or compensation reservoir.

In 1895 it was found necessary to construct a new gauge well at the head of the main, in consequence of the reduced quantity of water obtainable from the lower well. The theoretical discharge from this new well was 1,680,000 gallons per day; but when tested in 1893 by the Water Committee with a pressure equal to the level of this new well, the discharge was 1,400,000 gallons. In 1895 the discharge from the same level dropped to 1,387,000 gallons per day. In 1902 the discharge had fallen to 1,347,000 gallons per day. In 1907 the delivery was only 1,262,000 gallons per day. This reduced quantity again caused additional head to be used, and water was delivered from a relief-well situate above the level of the lower reservoir.

The author reported on the condition of the main in 1902, with estimates of cost, both of scraping and of laying a new main; the former being £1500, and the latter £40,000. But the question of scraping was delayed until 1911. The discharging power of the main at this time was reduced to 1,092,936 gallons per day; and it was decided to proceed with the scraping forthwith.

The main was carefully surveyed, and a section plotted, which showed several steep gradients. The author was anxious to find a scraper that could be easily manipulated in either direction with little head of water, preferring to work down the gradients rather than incur the risk of forcing the scraper over the hills with the consequent difficulty of flushing out the *débris*. This was ultimately found in the "Eric" patent scraper.



The "Eric" Patent Pipe-Scraper.

This machine is distinguished from other forms by reason of the pressure-heads being placed in front of the ploughs instead of behind, thus pulling the ploughs along, the detached incrustation, &c., following with the main body of water, instead of the ploughs and incrustation being pushed along by the pressure-discs—thus reducing materially, if not entirely, the danger of the scraper being jammed by *débris*. The pressure-heads are built-up with spring-steel blades in the form of cups, and are lined with leather buckets which expand and contract according to the nature of the main; thus utilizing nearly the whole of the available pressure.

An agreement was entered into by which the Corporation agreed to fix the necessary hatch-boxes, to provide labour, and to be held responsible for breakages due to scraping. The author was so confident that this form of scraper would eliminate ordinary risks of this kind that he recommended the Corporation to accept this risk; the amount paid for the use of the scraper being on this account reduced by one-half. The work of fixing hatch-boxes was then proceeded with. It may here incidentally be observed that the water consumption at Batley is 30 gallons per head per day for trade purposes, and 15 gallons per head per day for domestic supply. The hatch-boxes were specially designed to meet the varying pressures, and different thicknesses of the main. The positions of these required careful consideration, and were determined by three chief factors: First, the contour of the main and the positions of valves; secondly, the disposal of sludge and wash-water; and thirdly, bridge-crossings, where flat pipes having two waterways 9 in. by 10 in. each had been fixed on account of the little cover available at the time the main was laid. At these crossings, it was necessary to fix a hatch-box on each side of the bridge.

A number of these having been fixed, the first length was begun on Christmas Day, 1912; and between Dec. 25 and Dec. 29 the first four sections were completed without accident. Trouble was experienced through the multiple-gear valves not closing-down tight. Further hatch-boxes were fixed, and between Good Friday and March 26, 1913 (seven days), six sections were completed without trouble, except control of valves. Two pick shafts and a 6 feet wood crow-bar with iron shoe were brought out of this section. Work was again proceeded with between May 9 and May 14, and in this section the only cases where the scraper had to be cut out were due to flat pipes having been used to cross a small beck—the fact not being recorded on our drawings. The scraper head naturally jammed here, and had to be broken out, after which the flat pipes were replaced by circular ones. On the scraper being again inserted, it travelled to Bradley Railway Bridge, where it quietly came to rest. On opening the ground, a reflux valve was found, of which there was no record. Owing to the enlarged waterway in the body of this valve, the whole of the available water was passing the scraper heads. The valve disc was removed and the scraper pushed forward by hand, when on closing the lid the journey was completed without further trouble—a total run of three miles.

The machine was again taken back to Somerset Bridge and started for the second run, when all went well until it reached Bradley Canal Bridge, where it was again pulled up. On cutting out it was found that the scraper heads were compressed by long strips of lead, which had been cut from faulty joints during the first run, and picked up on the second. One of these pieces of lead weighed 20 lbs. and was 4 ft. 6 in. long.

In December the scraper was again inserted at Somerset Bridge, and run to the reflux valve, where the lid had to be removed and the scraper pushed forward. On closing the lid, the scraper proceeded to Cooper Bridge. Here, owing to the scraper head turning at right angles into the hole cut in the parapet wall of the bridge, and thus temporarily blocking the waterway, the water and sludge rose to the top of the footway, and in this way caused about 30 yards of the wall to slide down towards the river. Fortunately it remained in this overhanging condition until it was taken down and rebuilt. The cost of this was £30. Two wood straight-edges, one 9 feet long and the other 6 feet long, came out with the scraper at this point. The next section was completed without trouble; the scraper having been through all sections twice, and some sections three times.

With the exceptions above named, the work was carried out without accident. Not a single case of a fractured main or blown joint occurred in the whole 17 miles. Air-valves were not closed down, and were observed to close gradually and without shock as the scraper passed them—due no doubt to the low head of water used for propelling the scraper. The speed of the scraper was controlled to a walking pace, and was distinctly audible in most places without stethoscopes. The amount of incrustation was ascertained by weighing various sections cut out when fixing the hatch-boxes. It averaged 28 lbs. per yard, or 22 tons per mile. No difficulty was found in disposing of this material, which passed away as sludge with the wash water. The delivery of the main, which, before scraping, was 1,092,936 gallons per day, was increased to 1,527,462 gallons a day. This will be further increased when certain flat pipes and other obstructions have been removed.

The cost of the work was as follows:—

Hatch-boxes and fixing (capital)	£650
Scraping, including loan of scraper (maintenance)	600
Total	£1250
Cost per yard for hatch-boxes and fixing	5·2d.
Cost per yard for scraping, &c.	4·8d.
Total cost per yard	10·0d.

The main was laid in 1874 and 1875 at a cost of £67,480. The thickness of the metal is graded according to pressures, and ranges from $\frac{11}{16}$ inch to $1\frac{1}{8}$ inch. The sluice-valves have compound worms and wheel gearing. The air-valves are double, and have screw-down valves.

The cost of the main is made up as follows:—

Cost of land, &c.	£653
Parliamentary, compensation, commission, &c.	329
Laying	16,500
Total	£17,482
Pipes, &c.	50,000
Total	£67,482

These figures give the following averages:—

Construction, &c.	£17,482	say	£0 11 8	per yard
Pipes, &c.	50,000	,,	1 13 4	,,
Total	£67,482	say	£2 5 0	per yard

It is impossible to lay down hard-and-fast rules for pipe scraping; but the following observations may prove useful:

(1) The main should be carefully surveyed, and all possible information obtained as to the position of valves, special castings, &c.

(2) Where the main passes through private land, it should be pegged out; in roads and streets a note as to its position is sufficient.

(3) Hatch-boxes should be fixed as near to controlling valves as possible, and provision made in the lids for fixing pressure-gauges, &c.
(4) The author (after the trouble experienced with compound gear valves), would prefer ordinary valves with bye-pass valves attached.
(5) Ample outlet for sludge and wash water should be provided; and the main should be flushed out after each run.
(6) By scraping *down* gradients instead of *up* them, danger of damage to the main is much reduced.
(7) The degree of success attained will materially depend upon the care devoted to the preparations made in advance, and a full appreciation of difficulties likely to be met with. Perhaps the most important factor is a willing, cheerful, and intelligent staff of men, ready to face difficulties and delays, together with an abundant supply of tools and tackle.

DISCUSSION.

Mr. F. H. Brunt (Rochdale) said one point not noticed in the paper was the effect of the scraping on the colour of the water. He knew that there had been discoloration with oxide of iron in towns using moorland water. In cotton manufacturing districts, the presence of oxide of iron in the water produced considerable loss to the cotton spinners, owing to the staining of the yarn. He knew of cases where manufacturers had complained for twelve months after pipes had been scraped. As to the amount of incrustation per yard of pipe, he inquired the thickness that this represented. Also whether there were any lead services connected, and was any trouble experienced from ferrules projecting in the main?

Mr. C. H. Priestley (Cardiff) thought the amount of incrustation—28 lbs. per yard, or 22 tons per mile—was enormous. He could hardly think there was so much as this. He presumed, too, the author was not at Batley when the pipes were bought, because £50,000 for them, with an average price of £2 5s. per yard laid, was very high. He did not consider Mr. Barrowclough had shown any reason for the use of the "Eric" scraper. He had himself scraped about 1 mile of 20-inch main and 14 miles of 24-inch with a "Glenfield" scraper under difficult conditions; and there was no trouble from burst pipes. The working of the scraper was successful throughout, although they had for a distance of 100 feet a gradient of 1 in 2, and for a distance of 300 yards a gradient of 1 in 10; and under the canal and the River Taff, the main was 14 to 18 feet deep. It was a large scraper; and one could not scrape a large main of anything over 18 inches with the same facility as one could a smaller main. The total cost of the work was £7200, which included a good many incidentals, such as Venturi meters at both ends of the main, the relaying of a certain length of main, and the hatch-boxes required. The machines themselves were likewise bought outright. The total cost of this section of 24-inch main, which was about as long as the one Mr. Barrowclough referred to, was £54,000. This was laid in 1886-7. He knew the price of iron at that time was low, and probably when the Batley main was laid, it was much higher. The increased delivery of the 15 miles of main after scraping was something like 1¼ million gallons. He considered the work was very successful, and well worth the money spent upon it. To relay this length of main at the present time would, he estimated, cost at least £70,000.

Mr. S. C. Chapman (Torquay) believed that Torquay was the first town where a scraper was used, so far as they could find a record. This was in "Box's Hydraulics." The main referred to was laid in 1858, and was first scraped in 1866. During these few years, it had lost 51 per cent. of its capacity. Annually, the main had since been scraped. The scraper now in use was the Froude, which differed largely from other scrapers, but it worked without any trouble. On their pipe track, they had many parts in which the gradients were 1 in 3. They always worked up these gradients; and the scraper took them quite easily. With regard to working in either direction, he did not think there was anything much to be gained by doing so. Although scraping annually, they never had any bother with blown joints or split pipes. Everything must depend upon the condition of the main itself. As to the pressure heads being in front of the ploughs, he did not see anything in it; for the reason that, if the pressure heads were not absolutely tight to the circumference of the main, then the scraper would fail to drive along. One would infer from this that the pressure heads did a large portion of the scraping; and the ploughs which followed took up such things as the pressure heads left behind. As to getting rid of the *débris*, he did not think this point was one which could be considered with any seriousness, because when the wash-outs were opened, as the scraper travelled along, the whole of the *débris* was washed out, and so there need be no trouble about having an accumulation in front of the scraper. In his case, by scraping the main annually there was no discoloration. But if they scraped one of the small distributing-pipes where the flow of water was not great, discoloration was set up. Though he had scraped small mains in the past, he did not think he should do it again.

Mr. Priestley observed that in their case they had no trouble from discoloration, after properly washing-out the main.

Mr. C. W. S. Oldham (Ipswich): That applies to trunk mains only; not to distributing mains.

Mr. Priestley: Yes.

Mr. F. J. Dixon (Ashton-under-Lyne) said he believed if mains were uncoated, this made a great difference; and in a few years there would be incrustation. A pipe well coated inside might run 30 years before it wanted scraping. He believed, although Mr. Barrowclough had by scraping the main obtained an increased discharge equal to 44 per cent., he would have to scrape the main again in a very few years' time. He (Mr. Dixon) had scraped an 18-inch main; and although only two years had expired, he found it was necessary to scrape it again. In the first place, the increased capacity was equal to 27 per cent.; but judging from the present discharge, he had already lost 10 per cent. He should have thought that in Mr. Barrowclough's case it would have been advisable to purchase the "ferret" outright. Then he would have had it by him; and the cost would have been reduced every time he desired to scrape the main. In his own case, he adopted a power machine, worked by a petrol engine; but his experience had been most disastrous. The discoloration of the water lasted for at least a month. He had also experienced breakages owing to the use of the power machine; and he would not use it again. The scraper he had recently been using on the trunk mains was the "Kennedy," which he preferred to the "Eric." In the case of the latter, the pressure discs were in front, and were liable to become jammed. When the "Kennedy" scraper met a tongue of lead, it broke it up, and reduced it to pieces. He also thought the amount of incrustation mentioned in the paper was very heavy; the quantity on the 18-inch pipe he had scraped was equal to 10 lbs. per yard. He then referred to the experience of Mr. Watson, of Bradford, with cast-iron and steel pipes, which showed that that gentleman had found in cast-iron pipes about 1¼ inches of incrustation, while in steel pipes there was no incrustation whatever, which indicated that so long as the inner surface was smooth, and there was a good, carefully prepared coating, there was not much fear of incrustation.

Mr. W. R. Jenkins (Cardiff) said it would be interesting to know whether the discharge of the author's main as originally laid was measured, and what percentage of the original discharge was regained by the scraper.

Mr. A. B. E. Blackburn (Sunderland) asked when did it become economical to scrap instead of to scrape? Also what was the smallest size of main that could be economically scraped with this scraper? It seemed to him that they must have pretty bad water in some of these districts—especially in the Torquay district—if the mains had to be scraped every year. It would add to the value of the paper if Mr. Barrowclough would include an analysis of the water. Speaking for his own district, he had never yet had to scrape a main; and he did not think he ever should, although some of the mains were fifty or sixty years old. There was a little incrustation in them, but not a great deal.

Mr. H. Ashton Hill (South Staffordshire Water-Works Company) remarked that Mr. Blackburn had anticipated him in his remarks. But he might just say the collection of articles that Mr. Barrowclough got from the main was of a numerous, varied, and interesting character, and would make quite a good museum. He had not mentioned the barrowful of macadam that he (Mr. Hill) had found in similar work. The worst of macadam inside pipes was that it acted as a sort of valve—when the pressure came on, it closed the macadam up a bit, and when the pressure was reduced the macadam fell back again, and so the people got an intermittent supply. [Laughter.] Regarding the 22 tons of incrustation per mile of main, he had been wondering how many tons in the course of the year went through the consumers' taps, and of what did it consist? An analysis would probably show this. He had also been wondering whether it would not be economical to put up a filtering plant in order to take out all this solid matter.

Professor Jameson thought it would be a good thing if contractors ran a scraper through water-mains before they were accepted, in order to get rid of all foreign substances. He thought careful records should be kept of such things as special bridges, reflux valves, and so forth, in order that they should not in such work as this be pulled up by them. Hatch-boxes should also be put into small mains in the first place; and then the cost of the work would be considerably reduced, and the scraping could be done more regularly. He further mentioned that one advantage of having the ploughs in front of the pressure was that the water passing through the thin end of the space round the discs acted as a scour on the ploughs. The incrustation spoken of by the author was great; and it must have affected the quality of the water. As to discoloration, was it not possible that this was largely due to the sediment in the service-pipes themselves?

Mr. W. J. E. Binnie remarked as to the discharge capacity of the main. It seemed to have fallen off 17·4 per cent. by 1895; by 1902, 20 per cent.; by 1907, 25 per cent.; by 1911, 35 per cent.—that was to say, in the four years from 1907 to 1911, the fall had jumped from 25 per cent. to 35 per cent. As a rule, the discharge capacity fell off very gradually. Referring to the Coolgardie pumping-main in Australia, he said they had there 350 miles of steel main; and his firm were asked to recommend what should be done to protect it in future from the action that was going on in it. They came to the conclusion that the water was responsible—that air in solution in the water was one of the factors in the chain of chemical action which was essential before the incrustation took place. In various sections of the main, they found that, where a sudden increase of pressure disengaged air, the incrustation was greatest. It was found by experiment that, when they relieved the air occluded in the water, they made the latter inactive on iron. One of their recommendations was that the air should be removed from the water, and that it should be treated by lime.

Mr. Henry C. Adams thought the last paragraph of the paper the most important one. The success to be obtained by scraping depended upon the full appreciation of the difficulties to be overcome. In the course of his wanderings, he had come across a large number of cases where main-scraping had been a disastrous failure; and these had been more in country districts where the people had perhaps been dependent upon commercial rather than expert advice. They had entered inadvisedly into these schemes, and had been very sorry ever afterwards. The discussion had drifted on to the incrustation of pipes. A short time ago he was examining a stack of pipes, representing a mile or more, that had been taken up because of incrustation, which made the supply insufficient. The pipes had been in use the same number of years; but the incrustation varied within large limits. On looking into the matter closely, he came to the conclusion that the evidence pointed distinctly to the amount of incrustation varying with the perfection of the coating. The pipes well coated showed very little differences in incrustation; those which were badly coated were almost choked up. The special castings and the junctions particularly were incrusted worse than the straight pipes. It was a question whether the eddying of the water was not responsible for the incrustation. On removing the nodules, he found a pinhole through the coating which exposed the iron underneath. It seemed fairly obvious, if the nodule was reduced, the water had a more favourable chance of attacking the iron than if the nodule was left on. When once the main was scraped which had been attacked in this way, the chance was that it would have to be scraped periodically. The coating was not always oxide of iron. There were other substances; and if the coating was formed by something else than iron, his argument would not apply.

Mr. James H. Hutchinson (Paignton), in a written communication, said he had recently finished scraping an interesting section of 9-inch main, 17 miles long, and had had a variety of troubles. The scraper he first used got stuck and badly damaged; and as the work was very urgent, Mr. Chapman, of Torquay, lent him one to get his own out, and to finish the work. This one also stuck—within a mile of the start; and for the first six miles it frequently got lodged for a long time. He was 39 hours scraping the first six miles; the work being continuous. The 17 miles was eventually scraped in 75 hours. The whole length had been scraped before. The lead taken out of this 17 miles of main was altogether about 4 cwt. There were also stones (some about 4 inches thick), sand, gravel, bolts, and lumps of iron—all in addition to a very large quantity of corrosion in nodule form. On first examination, the condition of the coating after the removal of the nodules appeared to be excellent; but, on close examination, it was found that the coating was punctured under the nodules, the whole of the iron under them was attacked, and the iron removed, and only a graphite form of carbon left. The depth to which this change had taken place was in some cases as much as ¼ inch; and the outline of the area attacked coincided almost in every case examined with that of the nodule which had overlain it. The pipes came from France, and were extremely hard and tough, and were jointed by first caulking in a ring of lead, and then running with hot lead and caulking after. The water was derived from a peat gathering-ground in the heart of Dartmoor, and contained several bad peat-bogs. The total hardness of the water was about 3° after passing through a battery of pressure filters, containing a bed of magnesium oxide for hardening purposes. The water contained only a trace of iron before filtration, and none afterwards. The theoretical discharge of the main was about 618,000 gallons per twenty-four hours. Before the scraping was done this year, the discharge was 340,000 gallons per twenty-four hours; and since scraping, he had got as much as 689,000 gallons through in the twenty-four hours, after the main had had time to settle down. The usual discharge since scraping had been 686,000 gallons per twenty-four hours. He might mention a curious fact—the delivery of the main was greater now than when it was first laid about ten years ago. This was probably due to the amount of lead which had got into the pipes.

Mr. C. Clemesha Smith (Wakefield) said that, in a paper some time since, Professor Kendal seemed to indicate that incrustation took place more readily where the water was acid. In his own case, he had had trouble from incrustation; and the water, for a town's supply, was extremely acid. Some years ago, they had a Venturi meter, which, after it had been in use some time, was found to work very irregularly. It was usual for these meters to be cleared of air from time to time; but in their case, they found that they had to open the casing, and discharge the air once a day. On the meter being taken out, it was found that the internal aluminium had been eaten away. Apparently the acid water together with the aluminium had formed a gas—probably hydrogen—and so had disturbed the action of the meter. This showed that considerable effect did take place where one had two metals in a meter together with acid moorland water. In some 18-inch mains which he laid last year, he tried the effect of double coating, so that if one had an air bubble in one coating, the other would serve as a protection.

Mr. H. C. Head (Winchester) said, arising out of the question as to gravel, straight-edges, and other things discovered in some water-mains—[Laughter]—most of the gentlemen present, not being gas engineers, were probably unfamiliar with the method of laying gas-mains. In the past, gas-mains were stopped-off with bags, but recently the gas had been stopped-back by a thing called a gas-main stopper, which consisted of a wooden plug with rounded edges, connected to a long iron rod—probably 3 feet long. Then there was a rubber disc stiffened with an iron plate, so that there was 1½ inches of rubber all round the plate. As each pipe was laid, this device was pulled forward. The men got used to it; and there was practically no additional cost caused by putting it in, and pulling it along. It would prove a very effective sweeper for a water-main. Having a rubber edge, it did not disturb the inner coating in any way.

The President (Mr. T. Molyneux, of Stockport), looking at the data given in the paper, said he was wondering whether the incrustation grew slowly at first, and then exceedingly rapidly. He should like to ask the author how long he thought it would be before he had to scrape the pipe every year. Nothing had been said about trying to recoat the pipes *in situ* after scraping. Had it ever been considered or tried? It seemed to him that if they scraped mains, they should do something to prevent them incrusting again. He thought, if he were Mr. Barrowclough, he should even now be inclined to consider filtration.

Mr. Barrowclough, in reply, said they had had no trouble or complaints regarding the discoloration of water. There were no lead services on this main. The thickness of the incrustation was about 1¼ inches. As to its weight, 22 or 23 sections of the main were taken out, a yard from each carefully measured, and the average weight of the incrustation was 28 lbs. per yard. The price of the pipes was very heavy; but Mr. Priestley would perhaps remember that the price of cast iron was at that time £9 per ton. As to preference for the "Eric" or other scraper, these things were all matters of experience and opinion. His only reason for adopting this form of scraper was because he was satisfied there was an advantage in being able to work the scraper with considerably less head than was required for the form of scraper with the pressure discs behind. The whole of the available head was used in this form of scraper. Another reason was that there was no danger, in his opinion, of the machine being blocked in front with incrustation. They had a big trade interest involved in this water supply; and if they began to tamper with the water, which in its natural condition was good for all purposes, they would get into trouble. It was probable he would in five or six years have to run the scraper through the main again. As to the power machine, he had come to the same conclusion as Mr. Dixon, that it was altogether too stiff in its action. He had purchased a hand scraper with which excellent work was being done. As to the question of purchasing the scraper described, he had this in hand at the present time. He was scraping 3 and 4 inch mains by hand at 6d. per yard, including interest on the cost of the scraper. The discharge of the scraped main was being kept up. As to scrapping or scraping, circumstances would have to guide as to when the time came to do the one or the other. With very small mains, one would naturally prefer to scrap rather than scrape. The water was a soft moorland one, slightly on the acid side. As to the collection of things found in the main, of course it was laid before his time at Batley. He always preferred to brush and to flush new mains as laid.

A Dangerous Fused Cable at Oldham.

An alarming local occurrence was thus described in the "Oldham Chronicle" dated last Saturday week: At about 7 o'clock on Wednesday morning, the fusing of an electric cable caused a remarkable sight in Park Road, Oldham, near the corner of Hardy Street. At that point, on the Queen's Road side, there is a section-box on the footpath, through which a reinforcement of electric energy is supplied to the overhead tramway wires. The supply is carried from the underground main into the section-box and thence to the overhead wires by means of an insulated cable, which is led up inside the hollow pole from which the trolley wires are suspended. Through some reason—probably that some defect had developed in the insulation of the cable—there occurred a short-circuit in the standard pole; and the full voltage carried by the cable expended itself on the malleable steel of which the pole is constructed. The result was that the metal was instantly fused—burnt through at a point a little above half the height of the pole. The tube of the pole is at this point over half-an-inch thick; but the steel was melted immediately by the intense heat, and the upper part of the pole collapsed and fell to the ground, bringing down with it the two suspending wires and the feeder-cable. There was a series of brilliant flashes as the fusing occurred, and as the loose ends of the live wires came in contact with the ground and with the portion of the pole which remained; but the burn-out very quickly caused the automatic cutting-off of the current at the generating station by the burning-out there of the safety fuse on the switchboard. Fortunately, there was no human being nor any traffic of any kind in the immediate neighbourhood of the fallen wires and the pole at the time of the mishap, or serious, and probably fatal, injuries might have had to be recorded. The actual damage done is not of very great importance; and the tram service on the route was only suspended for a short time, as temporary repairs were quickly made.

The Quality of Darlington Gas.—At the last monthly meeting of the Darlington Town Council, Mr. Wooler referred to complaints which were being made respecting the quality of the gas; and he asked the Chairman of the Gas Committee the reason for the great diminution in the lighting power. Mr. Dixon, in reply, said the illuminating power of the gas was approximately 15 candles. His policy had been to produce gas at a reasonable cost, so as to encourage the use of it for heating purposes. The lower candle power was as good as the higher for incandescent burners, and produced equally as good a light. Mr. Wooler said they had been accustomed to have 17-candle gas; and he moved that it be an instruction to the Committee to produce it. The motion was agreed to.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The War and its Influence in Gas Sales.

SIR,—In this week's "JOURNAL," you allude to the influence of the war in reducing the sales of gas in various localities—notably in London. But in other directions the reverse action is only too apparent. At Aberystwyth, for instance, the increased output during the past fortnight amounts to 69 per cent. There are 7000 soldiers here; and these require an extra 700,000 cubic feet of gas per week—equal to 100 cubic feet per head. And there are 2000 more troops to come!

HENRY WOODALL.

South Parade, Llandudno, Jan. 6, 1915.

The Attack on Coke-Oven Bricks by Salty Coals.

SIR,—In your issue of Dec. 8, "Event and Comment" refers to a phenomenon known, but not frequent, in coke-oven practice—namely, the deposition of carbon in the pores of the brick leading to its ultimate destruction. This occurrence is not unknown in gas-works practice; and it certainly does not bear on the subject your contributor originally introduced, when he made the statement that corrosion of coke-oven bricks is more marked in bricks containing a high percentage of alumina. On the contrary, the resistance to salt increases directly with the alumina contents, and as the brick becomes less acid and more basic. Kaolin and other bricks high in alumina are in extensive use in Eastern Germany, coking salty coals; and they perfectly resist the action of salt.

In discussing the subject, he mixes up the relations of chlorine and sodium, and wrongly concludes that I advocate the use of aluminous bricks. These have qualities other than resistance to salt which render them less suitable than quartzite bricks for coke-oven work. One of the most resistant bricks in a highly "salty" neighbourhood is the silicious brick of which I have already given an analysis. There are factors as important as analysis, of course; but of these we have only a vague knowledge.

It is in the hope of reviving the discussion, and not to cavil at your contributor's interesting comments, that I return to the subject.

W. COLQUHOUN.

Sheffield, Jan. 9, 1915.

The Typhoid Fever Epidemic at Kenilworth.

SIR,—The paragraph in the "JOURNAL" of the 29th ult., headed "Sequel to a Typhoid Epidemic," in the context suggests that a second epidemic has occurred, from which the County Court action to which you refer arose.

There has been but one epidemic of typhoid fever in Kenilworth, and that occurred in December, 1913. I hope, therefore, you will give as much publicity to this explanation as was given to the paragraph to which exception is taken.

A. E. DENCER, Secretary,
Kenilworth Water Company, Limited.

Kenilworth, Jan. 2, 1915.

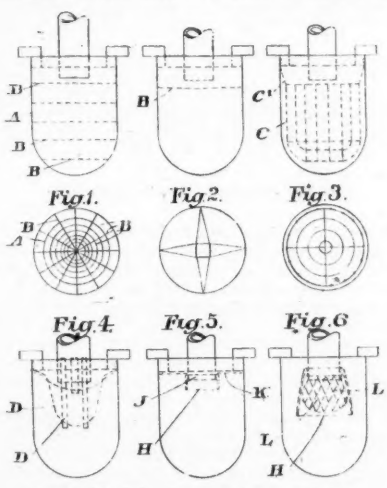
REGISTER OF PATENTS.

Incandescent Gas-Burner Mantles.

CAMPBELL, F. W., of Bangor, co. Down.

No. 28,258; Dec. 17, 1913.

The inventor proposes to provide the mantle with internal incandescent means consisting of an internal part or filament (somewhat analogous in effect, he says, to the filament of an electric lamp), the fabric or structure of which does not retain or confine the gas flame



Campbell's Incandescent Burner Mantles.

between it and the inner surface of the mantle. Thus when the gas is lowered contact with the flame "produces incandescence in the interior of the mantle, and as the supply of gas is increased the incandescence reaches, or is conveyed to, the outer part of the mantle." The filament is composed of internal incandescent threads (suspended from a mantle ring) arranged to assume "any artistic or other desired shape, either singly or in combination with one another."

Fig. 1 is an elevation and plan of one form of the mantle. A is the outer part of the mantle, and B an internal filament. In this instance the series of web-like diaphragms forming the internal filament B are connected to the outer part of the mantle. Although there are five of these shown in the figure, the patentee points out that one or more may be used as desired, and the formation of the web or diaphragm, or its equivalent, made to any desired pattern, shape, or configuration, and the filament can be so constructed, shaped, arranged, or adapted according to the varying development and shape assumed by the jet, so as to give the maximum of incandescence with the minimum of gas consumption."

The mantle shown in fig. 2 is a modification in which only one crossing diaphragm B is used. In this case, it is connected with the mantle proper at four points.

The mantle shown in fig. 3 has the internal filament C formed of a series of concentric and connected rings supported by threads C^1 from the mantle ring.

Fig. 4 is another modification in which the incandescent filament D is suspended from the mantle ring. It comprises a number of threads crossing from side to side of the mantle and in different directions.

Fig. 5 is an elevation of a mantle with a simple form of incandescent filament H attached to, and shown below, the burner J. In fig. 6, in addition to the filament H similar to the filament H in fig. 5, a web-like filament B is attached to the burner nozzle above.

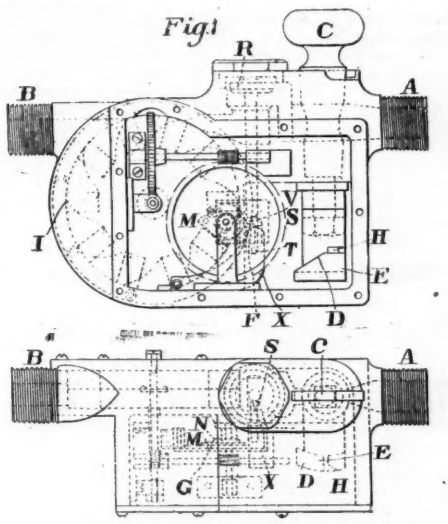
Regulating Gas Supply to Gas-Fires.

RASCH, L., of Horseferry Road, Westminster.

No. 21,376; Sept. 22, 1913.

This invention has for its object to provide simple means of turning off the gas supply from some of the jets after they have been lighted for a predetermined time. It is especially adapted for use with duplex burners, so that when the fire has been lighted for a period of time some, or all, of the burners may be turned off, or partially turned off.

In apparatus made in accordance with the invention a fan is so disposed in the gas-passage that the power of the gas in flowing past it is utilized practically to its full extent in causing a rotary motion to the fan. For this purpose, the line of passage of the gas is tangential to the periphery of the paddle, and the passage is disposed above the axis of the wheel—the cross-section of the gas passage being substantially co-terminous with the area of the vanes of the wheel, as described in patent No. 21,375 of 1913. The present invention comprises the combination of a fan wheel of this type with a valve adapted to be operated by the fan.



Rasch's Gas-Regulator for Gas-Fires.

A diagrammatic elevation of one form of the apparatus is given (with the cover removed); also a plan.

In operation, assuming the valve R to be in its raised position, and the gas to be passing in at A and out at B, rotating the fan C and in turn the cam M, the nose of the cam striking the pin S dislodges it from the recess V, thus causing the valve to drop and shut-off the flow of gas. The gearing is so arranged that it takes about 60 minutes to close the valve after the burners have been lighted; but the time can be adjusted by altering the gear ratio in the process of manufacture.

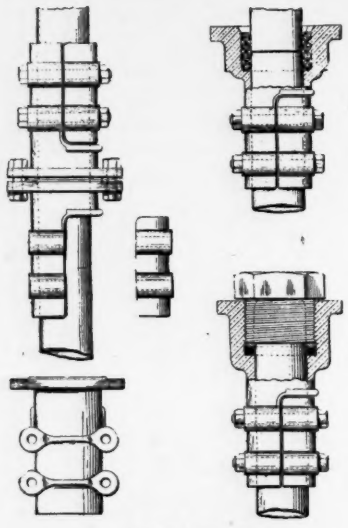
To raise the valve, and so set the apparatus in order for again working, the handle C is turned so that the slope D of the shoe E engages the curved edge of the finger X and the lower end of the stem of the valve R. On further turning the handle, the finger is raised so that its bevelled edge F engages the pin G, and so moves the cam M round as far as is permitted by the pins on the disc N, so as to move the peak of the cam out of the way of the pin S, which by this time is in a position to enter the slot V. On the continued movement of the shoe the flat surface of it passes beneath the pin T until it is struck by the wall H, when the valve is turned until the pin S is passed into, and retained in position by, the slot V. The valve is thus held open until the fan wheel I has rotated the cam M sufficiently far to turn the valve R and allow it to fall again upon its seat.

Couplings for Pipes or Tubes.

KOGAN, M., of Finsbury Pavement House, E.C.

No. 28,617; Dec. 11, 1913.

This invention relates to pipe couplings of the kind which are split for a portion of their length and have a detachable cap or a clip arrangement. The coupling is said to differ from the known types of coupling in that they have, beside the detachable cap, a circular flange on one end (on the portion not split), in order that two couplings, on the ends of the tubes to be coupled, may be readily connected by bolts. In another form of the invention one end of the coupling has a faucet end to accommodate a spigot and packing; while yet another form has a faucet internally screwed for a screwed plug, which acts as a stop end. The coupling is intended for use in joining pipes where making-up lengths are used, and where it is not convenient to thread the ends of the pipe and join them by an ordinary internally screwed socket, or by a pair of flanges which are screwed on to the ends of the pipe and thereafter connected face to face by bolts or studs.



Kogan's Pipe Coupling.

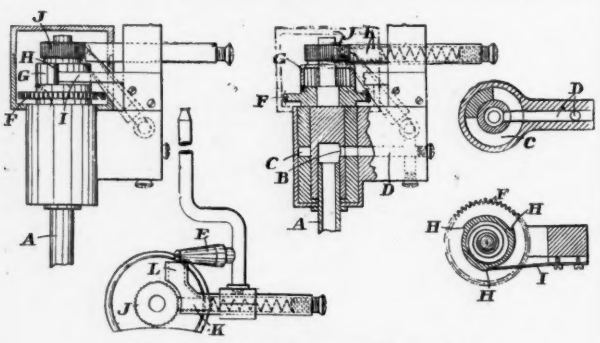
Three forms of couplings embodying the improvements are shown. The first is a side elevation of a pair of couplings joining together the ends of two ordinary pipes—the upper coupling being shown as it appears on the pipe; while the lower coupling is shown detached at the right-hand side. There is also a view at right angles of one of the same form of couplings. The second form shows (partly in elevation and partly in section) a modification of the coupling, provided with a faucet instead of a flange; two pipes being connected by spigot-and-faucet joint as shown. The third form shows a modification in which the coupling is adapted to be used in making a blank or stop-end to an ordinary pipe, after the manner in which a blind flange is used on an ordinary flanged pipe.

Automatically Lighting and Extinguishing Gas-Burners.

ROGERS, F. H.; a communication from Leon Radet, of Paris.

No. 29,013; Dec. 16, 1913.

This apparatus (as shown) essentially consist of a cylindrical piece in which the gas supply pipe A is mounted, and a lateral passage B which connects the upper end of the pipe with the periphery of same.



Radet's Gas-Burner Lighter and Extinguisher.

The plug of the tap has a passage C corresponding with the passage B and extending over the largest part of the periphery of the plug, so that the passage B is shut off only during one quarter of revolution of the plug. The casing of the tap has a passage D which terminates with its one end in the inner wall of the casing and at its other end at the nozzle E, which is connected with a bye-pass. Upon the shaft of the tap is keyed a toothed wheel F, which is driven from clockwork mechanism controlling the supply of gas to the burners at predetermined times. Above the wheel F is mounted a drum G, which is connected with the shaft of the tap by a spiral spring like the barrel of a watch. The drum therefore is independent of the wheel but connected with it by a stud which laterally projects from the drum and engages with a circular groove of the wheel F in such a manner that the spring has always a certain initial tension. The groove is equal to one-third of the circumference of the wheel. The periphery of the drum has three ratchet teeth H, against which bears a flexible blade I fixed on the body of the apparatus. On the drum a milled disc J is fixed, against the rim of which is pressed (through the action of a spring) a pill K of ferro-cerium. The sparks produced when the milled disc rubs along the ferro-cerium pass through the lateral tube L and ignite the gas which flows out of the nozzle E.

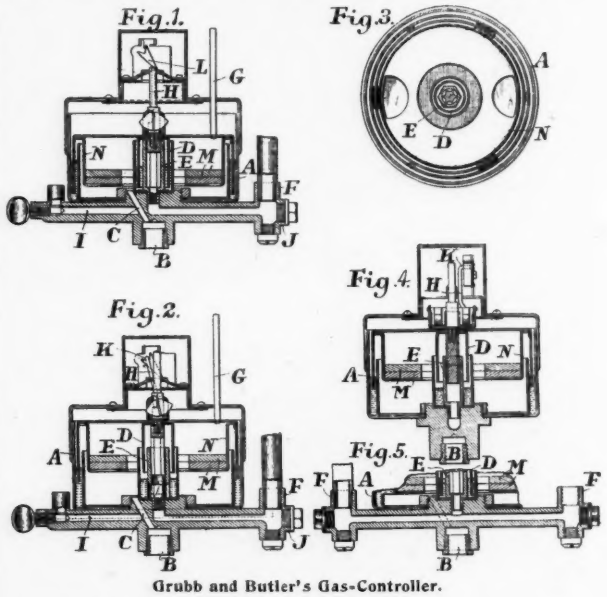
The device operates as follows: At the time the gas has to be lighted the device which stops the toothed wheel F is released from the clockwork so that the wheel rotates and causes the tap to turn and supply gas. As one of the teeth H of the drum G strikes against the blade I the drum is prevented from turning, and the milled wheel J remains at rest while the tension of the spring increases in consequence of the rotation of the shaft of the drum G. As soon as this tension is sufficient to make the tooth clear the blade, the drum with the milled wheel, being suddenly released, turns rapidly, so that the wheel rubs along the pill K, whereby sparks are produced which ignite the gas at the nozzle E, and the flame goes over the bye-pass to the main burner. The tension of the spring and the form of the teeth H are arranged in such a manner that the release of the drum G takes place after one-third revolution, wherefrom it results that during one complete revolution of the toothed wheel one, two, and three times in succession sparks are produced, so that if the first spark should fail to light the bye-pass flame the second or third spark would do so. The end of the rotation is utilized for producing the extinction of the flame, and the wheel, after having completed a revolution and produced the three series of sparks as explained, is ready for a new operation.

Gas-Controllers.

GRUBB, D. B., and BUTLER, H. B., of Birmingham.

No. 2554; Jan. 31, 1914.

The controller constructed according to this invention comprises: A main bell immersed in a bath of mercury and adapted to be lifted on the application of an increased gas pressure; a depending bell-valve carried by the main bell, and dipping into a secondary bath of mercury; a central outlet pipe passing through the secondary bath, by which the gas is led to the burners; and a weighted or spring lever mounted upon the top of the bell, and having at its upper end a finger or hook which, when the bell rises, engages with, and is retained by (when the pressure is reduced), a catch or gate device, until the application of a subsequent pressure wave, when the finger or hook is released, and the bell is allowed to fall so as to cut off the gas.



Grubb and Butler's Gas-Controller.

Fig. 1 is a vertical section through the controller; the bell being in its lowered position with the gas cut off. Fig. 2 shows the bell suspended in its raised position, to allow the gas to pass to the burners. Fig. 3 is a horizontal section. Fig. 4 is a section at right angles to fig. 2. Fig. 5 shows how the gas may be led to the burners.

The controller body, as shown, contains an annular bath or seal of mercury, immersed in which is a main bell A. The gas is admitted at B through the passage C, so that it acts upon the underside of the bell. The latter has fixed within it a centrally depending supplementary bell or cap D, which normally dips into a secondary bath of mercury in the base of the apparatus; while passing through the bath is a central open-ended tube E, whose lower end communicates with a passage leading to the outlet branch F. The bell D dipping into the mercury normally closes the outlet of the gas through the tube E, and so constitutes a valve. The bell A carries a guide rod G (working through an opening in the top), to enable the bell to be worked by hand for testing purposes. The rod also serves to prevent any rotation of the bell—thus keeping the lever H in its proper position with respect to the gate or retaining device described later on.

A bye-pass I leads from the passage C to a pilot jet to ignite the

main burner. But for use with an inverted burner an auxiliary branch J is provided, closed by a plug which, when the branch is required for use, is transferred to the branch F.

Pivotally mounted upon the top of the bell A is the vertically disposed swinging lever H which at its lower end is weighted or acted upon by a spring, and has the extremity of its upper arm bent at right angles to the plane in which the lever swings—forming a finger or hook K. When the bell A rises, this finger is adapted to engage with the inclined or bevelled under-surface of a fixed catch or gate device L having a recess or notch in its upper end, and also a bevelled face which is arranged above a pair of laterally separated stops.

The action of the controller in a two-wave supply system is as follows: Assuming the valve D closed and the gas cut off, the application of the first pressure wave will cause the main bell A to rise (the valve or cap constituted by the supplementary bell D rising with it) out of the fluid in which it is normally immersed—thus allowing the gas to pass through the central tube E to the burner, as in fig. 2. As the bell rises, the projecting finger K at the upper end of the swinging lever H engages with the bevelled underside of the catch device L; the lever swinging to one side until the finger has cleared the top edge of the catch, when it engages with the outer side of one of the stops. On the pressure wave ceasing, the bell falls slightly until arrested by the finger engaging with the notch in the upper end of the catch; the weighted end of the lever causing the latter to move towards the vertical, until the finger comes against a shoulder or stop (at the end of the recess in the catch) situated to one side of the normal vertical axis of the lever and between the two stops referred to above. The bell remains suspended, and the gas continues to pass to the burner until it is desired to extinguish the light, when a second pressure wave is introduced into the system, causing the bell to be slightly lifted to take the upper end K of the lever H clear of the stop shoulder on the catch device. The end of the lever is then further swung over by the weighted lower end, and engages with the inner face of the second stop; so that on the second pressure wave ceasing, the bell A descends and the upper end of the lever falls upon the outer or upper bevelled surface of the catch, and allows the bell A to completely descend and the supplementary bell D to again enter the mercury and cut off the gas.

The bell A is weighted by lead discs M contained within a depending cup or holder N detachably secured to the bell; its upper flanged edge having gaps which can be passed over indented parts of the bell, so that it can then be rotated to bring the ungapped portion of its edge over the projections.

In the event of the apparatus shown being installed in a system in which other controllers are used which operate on a three-wave cycle, in conjunction with a plurality of burners, the retaining device L is provided with two recesses or pockets in its upper edge, with a double stop above; the finger at the end of the swinging lever falling into the second pocket after being lifted from the first on the application of the second pressure wave—thus keeping the bell suspended and allowing the gas to pass to the burner, until the application of the third wave.

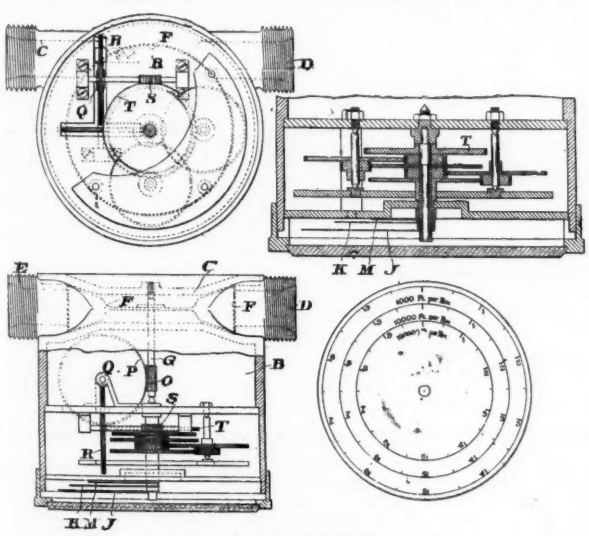
Where it is desired, in such a three-wave system, to extinguish alternate lights on the application of the second pressure wave, the second recess in the retaining device of the controller appertaining to each burner to be extinguished is made deeper than the first recess; so that when the lever falls into this recess the bell descends so as to cut off the gas, but on the application of the third wave the bell is prevented from again rising sufficiently to open the gas supply, by means of a stop-device with which the lever engages—the stop being situated, however, so as to enable the lever to rise sufficiently to clear the horn of the retaining member, the bell completely falling.

Gas-Meters.

Rasch, L., of South Norwood, S.E.

No. 852; Jan. 12, 1914.

The object of this invention is to provide a meter of small size capable of indicating upon a dial a large quantity of gas consumed. The meter comprises (1) a combination of a paddle or fan-wheel disposed in the gas-passage in such a manner that the flow of gas is tangential to the periphery of the paddle, and preferably above the axis of the wheel; (2) trains of wheels with three or more hands coaxially mounted and operated by the fan wheel; and (3) a dial provided with three or more scales recording the quantity of gas passing through the meter. Such a meter is said to be especially adapted for use as a discount or rebate meter, and "if more than three hands are employed may be used for general consumption purposes."



Rasch's Rebate Gas-Meter.

Fig. 1 is an elevation of the meter, with the dial removed. Fig. 2 is a plan with the outer casing broken away to show the mechanism. Fig. 3 is a diagram of the trains of wheels. Fig. 4 shows the dial.

The case is provided with a compartment B having a gas-passage C with an inlet D and outlet E. F is a fan or paddle wheel mounted on a spindle G in the compartment B. The passage C is disposed tangentially to the wheel. The dial is marked to read up to 100,000 cubic feet. One hand J is worked by the fan wheel through the worm O, wheel P, worm Q, wheel R, worm S, and wheel T. The hands K and M are similarly worked by a train of pinions, wheels, &c. —the hand J being regulated to read 1000 cubic feet per revolution, the hand K 10,000 cubic feet per revolution, and the hand M 100,000 cubic feet per revolution.

Gas Grilling Apparatus.

Richmond Gas Stove and Meter Company, Limited, and Jones, S. F., of Warrington.

No. 6468; March 14, 1914. No. 12,593; May 22, 1914.

This combined invention has reference to gas apparatus for which the following claims are made: (1) Having side or side-and-end grill plates extending down from the upper horizontal grill plates, at an inclination, or at right angles to the latter plates. (2) Having horizontal grill plates and side or side-and-end grill plates depending therefrom, and ledges or flanges on, or connected with, the side plates or parts adapted to serve as supports or runners for supporting suspending parts or ledges on the griller tin or receptacle, and upon which the latter can be run in and out. (3) A grill pan or receptacle, having upwardly projecting side parts with turned-over flanges at the upper edges, adapted to fit over and run in and out on flanges or ledges on the griller plates. (4) A combination of grill plates and ledges or flanges referred to in the other claims.

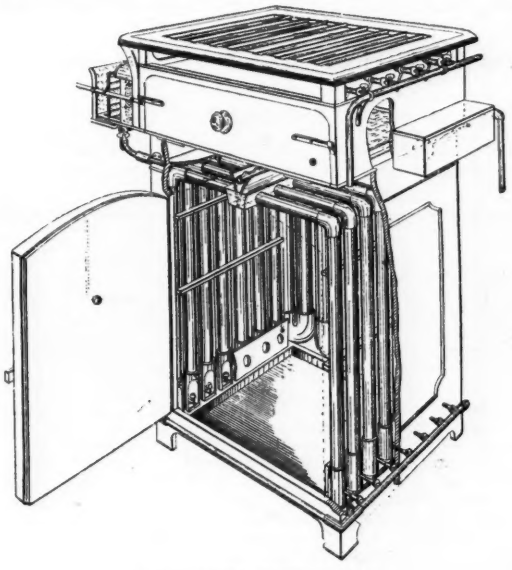
Gas Cooking-Stoves.

Turner, R. C., of Tulse Hill, S.W.

No. 9546; April 17, 1914.

This invention relates to combined gas cooking stoves and steamers; the chief objects being "to enable cooking to be done in a more hygienic manner and under more favourable conditions than heretofore, and to enable food, &c., to be either roasted, steam-cooked, or grilled by one and the same apparatus."

The type of stove preferably employed is one wherein the fumes from the burning gas, instead of being allowed to come in direct contact with the food within the oven, are conducted through tubes arranged therein. The combined stove and steamer is provided with a separate burner for heating the steamer, which can be used when the heat from the stove is insufficient or is not available, and also, if desired, with a griller. Thus, in cooking a meal, the patentee points out, the stove, steamer, and griller can be used simultaneously, "which results in a considerable saving of time and trouble and in economy of heat."



Turner's Gas Cooking-Stove.

The combined stove and steamer may (as shown) be provided with a griller preferably arranged at one side of the steamer and the fumes from which are led under the steamer "so as to utilize the waste heat."

The heat flowing from beneath the steamer, and also that from the griller, are "syphoned through a sinuous flue arranged at the back of the oven, so that heat therefrom may be radiated into the oven, thereby effecting still further economy of heat."

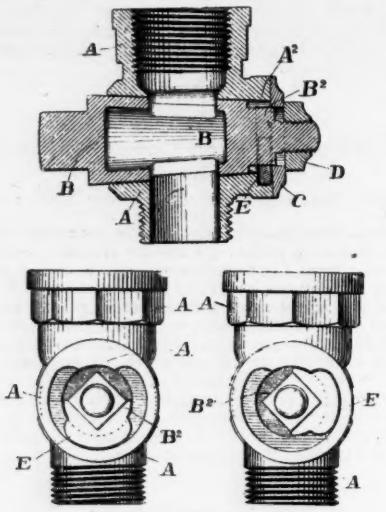
The preferred manner of putting the invention into practice is illustrated, and no detailed description of the arrangement is needful.

Taps or Stop-Cocks.

BISSEKER, H., of Birmingham.

No. 11,972; May 15, 1914.

This invention relates to stop-cocks in which knighting pins for limiting the rotation of the plug in the barrel of the tap are dispensed with. The patentee remarks that with taps unprovided with knighting pins it is usual to make the washer (which is fitted on the square at the lower end of the conical plug, and which closes the lower end of the barrel of the tap) with a teat or projection to engage in a curvilinear channel or groove in the body of the tap, the ends of which limit the action of the plug.



Bisseker's Gas Stop-Cock.

He proposes to employ on the lower or square end of the plug an ordinary or plain washer, and combine with the plug a loose or separate piece the inner edge of which has a right-angle V notch of a size proper to nearly fit two sides of the square at the lower end of the plug—the outer edge having a nearly semi-circular figure of the radius of the lower end of the barrel of the tap. The loose piece is confined between the ordinary washer and the lower end of the conical part of the plug. On the interior of the lower end of the barrel there is a projection against one or other side of which the loose piece is brought by the turning of the plug in one or other direction—the turning of the plug being thereby limited to a quarter or semi-rotation.

The gas stop-cock constituting the invention is shown in longitudinal section, and as cross sections with the plug fully on and turned fully off.

PARLIAMENTARY INTELLIGENCE.

GAS AND WATER PROJECTS FOR THE SESSION.

Proposed Expenditure.

The following estimates have been deposited of proposed expenditure on gas and water works under powers sought in Private Bills promoted for this session, which are now being noticed in the "JOURNAL." The names in parentheses are those of the engineers of the respective schemes.

	Total.
Ashington Urban District Council (Messrs. G. H. Hill and Sons)	£73,000
Barnoldswick Urban District Council (Mr. E. J. Silcock)	99,155
Chelmsford Corporation Gas	60,000
Clackmannan County (Alloa and Tillicoultry Water) (Mr. W. A. Tart)	30,000
Doncaster Corporation (Mr. F. Oscar Kirby)	16,000
Glasgow Corporation (Mr. J. R. Sutherland)	327,000
Irvine and District Water Board (No. 1) Bill (Messrs. Babtie, Shaw, and Morton)	70,000
Irvine and District Water Board (Emergency Powers) Bill	20,000
Lanarkshire County Council Water (Mr. J. M'Millen)	110,000
Lurgan Urban District Council	5,000
Metropolitan Water Board (Mr. J. W. Restler)	682,500
Plymouth Corporation	60,000
Port Glasgow Gas and Burgh Extension (Mr. G. P. Mitchell)	70,000
Southend Water (Messrs. T. & C. Hawksley)	49,300
South Staffordshire Water (Mr. H. Ashton Hill)	150,000
Sutton District Water-Works (Messrs. W. Vaux Graham and G. T. Derry)	85,000
Weardale and Consett Water (Messrs. T. & C. Hawksley)	667,280
Wolverhampton Corporation Water (Mr. E. A. Woodward)	120,000

LEGAL INTELLIGENCE.

THE CHARGES AGAINST WALTON GAS OFFICIALS.

Further Indictments—Question as to Place of Trial.

At the Surrey Quarter Sessions, at Kingston-on-Thames, last week, the case of *Rex v. Lamb and Ross* was mentioned. The defendants, it may be remembered, were officials of the Walton-upon-Thames and Weybridge Gas Company.*

Mr. W. H. MORESBY, who appeared for the Crown, said the accused had been committed on charges of larceny, and the prosecution proposed to add to the indictments six other charges relating to the falsification of books. He therefore asked the leave of the Court for the placing of these charges, which were of misdemeanour, before the Grand Jury, in order that the whole matter might be thoroughly investigated.

Mr. NICHOLSON, who appeared for the defendant Lamb, said a rule *nisi* for a *certiorari*, in regard to an application for the changing of the place of trial, had been granted by the Divisional Court, and the matter would be again before that Court on the first day of the Hilary Sittings. He therefore applied that the hearing of the indictments might be respited. If the High Court granted the *certiorari*, the case would go to the Assizes; but if the rule were not made absolute, it would go to the Sessions.

Mr. MORESBY said he had not the slightest objection to the application, so long as the two men were tried somewhere and somewhen. He, however, raised questions of bail and costs.

The CHAIRMAN (Sir Charles Walpole) observed that, if the rule were made absolute, the case would concern the Court of Quarter Sessions no further.

The Grand Jury found a true bill against both defendants on the charges of felony and misdemeanour.

The Court respited the hearing; admitting defendants to bail—themselves in £400 each, and two sureties of £200 each. The Court also made an order for costs, the amount to be fixed by the Higher Court.

* See "JOURNAL," Vol. CXXVIII., pp. 315, 620, 679.

DERWENT VALLEY WATER ASSESSMENT.

Though obviously, from the magnitude of the scheme, it was impossible to avoid a very heavy charge for legal expenses, it is evident that the outlay upon litigious proceedings in connection with the Derwent Valley water scheme has far exceeded original expectations. The cost involved by the parliamentary fight was inevitable, as were outlays in some other directions; but the internecine feud between members of the Joint Board, culminating in Sheffield's abortive attempt to free herself from a certain measure of financial responsibility, involved a heavy and unexpected impost.

Of purely unavoidable expenditure for legal purposes in relation to the Board's work, a further example has been forthcoming in the rating appeal in which the deferred judgment was delivered at Derbyshire Quarter Sessions last Wednesday. The Board had asked the Court to further reduce the assessment of that portion of the Howden reservoir which is situate in the parish of Hope Woodlands, Chapel-en-le-Frith Union. The Assessment Committee had, upon objection, reduced the amount to £22,667 gross and £17,000 rateable—these figures being based upon the total capital expenditure on the undertaking, *plus* a percentage. In support of the appeal the Board had, however, urged that abnormal and unforeseen expenditure should also have been taken into consideration. And they succeeded; the Court deciding in their favour with costs, and fixing the gross estimated rental at £20,544, and the rateable value at £15,408.

The matter is apparently not to be allowed to rest here. Leave to appeal was granted by the Magistrates, whose decision, it transpired, was not unanimous—there being one dissentient.

Obtaining Gas-Mantles by False Pretences.

At the Dudley Quarter Sessions, on Friday, before Mr. W. J. Disturnal, K.C. (the Recorder), a man named Alfred G. Cook, of no fixed abode, was indicted for obtaining 36 gas-mantles by false pretences. The accused pleaded guilty. The Recorder inquired of Mr. Lewis Elston, a tradesman of Dudley, to whom the prisoner sold some of the mantles, whether he knew him. Mr. Elston replied that he did not; but he was accustomed to buying from persons calling at his shop whom he did not know. The Recorder said it was a very dangerous practice, and the sooner he changed his system the better. Mr. Elston said men hawked these articles in the ordinary way; and he never bought less than dozen lots. It was stated that prisoner had been charged with larceny and false pretences in Lancashire and Cheshire, and nearly all the convictions related to electrical fittings. The Recorder said it was clear that the prisoner was regularly addicted to crime, and a dangerous form of crime to a commercial community. He would be sentenced to twelve months' imprisonment.

Gas-Works Clinkers.—A correspondent of a Belfast paper suggests to the Corporation of the city that the Gas Committee might turn their attention to the manufacture of gas-works clinkers with quarry residuals into stone, which would have the appearance of grey granite. He says that Salford has taken up the process, and expects to produce a strong, clean, white stone, suitable for building purposes, from clinkers from the refuse destructor alone. The process he describes as a new one, and adds that it has been held that the product is so good that it is likely to work "a revolution in the building trade."

MISCELLANEOUS NEWS.

STANDARD QUALITY SULPHATE OF AMMONIA.

An Important Move by the Sulphate of Ammonia Association. A Warning from America.

We have received from Mr. D. Milne Watson (the Chairman of the Sulphate of Ammonia Association), for reproduction in our columns, a copy of the following letter which has recently been sent out, together with the memorandum referred to therein.

Dear Sir,—With reference to the communication recently addressed to you on the subject of the quality of sulphate of ammonia, I have the pleasure to send you herewith a short printed memorandum indicating how sulphate of a good quality may be made, even with small plants. In view of the pressing importance of the question, the Selling Committee propose to engage the services of an expert foreman sulphate of ammonia maker, who will be available to give advice as to the design of the plant and its practical working to such members of the Association as may desire it. It is not proposed to make a charge to members for this service; but they will be expected to pay the adviser's travelling expenses from Westminster to their works and back. Applications for advice should be addressed to the Secretary of the Association at this office.

I also enclose a copy of an unsolicited letter recently received by a firm in this country from an American business house which emphasizes, in a striking manner, the necessity of making high quality sulphate of ammonia.

(Signed) D. Milne Watson,
Chairman of the Association.

84, *Horseferry Road, Westminster, S.W.*,
Jan. 4, 1915.

[Enclosures.]

SUGGESTIONS FOR THE MANUFACTURE OF HIGH-TESTING SULPHATE OF AMMONIA.

In a former pamphlet, entitled "Quality," some of the reasons which make it desirable for manufacturers to produce high-testing sulphate of ammonia were pointed out, and the regular production of a salt containing 24¾ to 25 per cent. ammonia, and not more than 3 per cent. moisture nor ½ per cent. free acid, was advocated. The following suggestions are offered to manufacturers as a reminder of the means whereby this standard may be attained and maintained.

Purity of Materials.

The first point to consider is that the materials with which the salt is manufactured should be pure. The acid should be as free as possible from iron and arsenic, and should never contain more than a maximum of ½ per cent. Fe_2O_3 or 0·05 per cent. arsenic. Acid should also be free from suspended matter. Care should be taken to see that the liquor is free from oil or tarry matter.

Control of the Still.

Priming of the still, leading to the production of coloured salt, should be avoided. No condensed liquor should be allowed to enter the saturator, and if the latter is some distance from the still, a catch-pot should be interposed.

Control of Saturator.

It is of the utmost importance that the saturator should work with perfect regularity; otherwise the formation of blue salt or an excess of free acid will ensue. In all cases the acid should be supplied from a raised tank, so that a constant and adjustable feed to the saturator can be arranged for.

The liquid in the saturator should be frequently tested with the hydrometer, and should be kept as nearly as possible at 58° Twaddel. This can only be secured by having a steady inflow of acid.

The successful drying of the salt depends largely on its physical condition and its free acid content, a product of a coarse crystalline nature being open and easily drained and dried. The conditions conducive to the production of a salt of this kind vary with different plants; but the working strength of 58° Twaddel, mentioned above, will in most cases be found suitable.

It is important that the liquid should never be allowed to drop below 56° or to exceed 60° Twaddel. At less than 56°, local alkalinity occurs, and blue salt is formed. At more than 60°, the excess of free acid causes the formation of a dirty floury salt, containing a large excess of free acid, which can be removed only with difficulty.

Draining and Drying.

On large plants a centrifugal machine is usually employed for the draining and drying of the salt, and this is no doubt the best means carrying out these operations. But the absence of a centrifugal of machine is no insuperable obstacle to the production of a well-dried salt, for this can be secured by natural draining. For this purpose it is essential to have a draining-board with false bottom.

Provided that the saturator has been kept under proper control in the manner indicated above, there should be no difficulty in producing sulphate of ammonia of 25 per cent. strength.

Higher British Quality Required in America.

Accompanying the preceding documents was the following copy of a letter on the subject of the quality of sulphate of ammonia addressed by an American firm to one in Great Britain.

Dear Sirs,—We have been discussing with your representative, several times during his visit to us, the absolute necessity of the British manufacturers taking advantage of the present situation to improve the mechanical condition of sulphate of ammonia to bring it on a par with the material that had been shipped by Germany to the United States prior to the war.

Every shipment of German sulphate of ammonia which came into this country was favourably commented upon by the receivers, not only on account of the beautiful mechanical condition, but also due to the bags being in perfect order when delivered. There was no rotting of the bags, and thus practically no loss in weight or test. If the war had not brought a stoppage to shipments of German sulphate of ammonia, we fear the British production would have been discriminated against, as the advantages of the German stuff were very marked. In spite of the superior condition of the German sulphate of ammonia, the price of this product was as low as, and in a great many instances lower than, the British make. You can, therefore, see how absolutely essential it is for your manufacturers to immediately take steps to protect their interests in this market by turning out goods equal in every respect to the German product. We are satisfied that you must feel with us that as soon as the war ends Germany is going to make a desperate drive for the American business again, and you certainly do not want to sit by and allow her to take from you what you have worked for a number of years to build up—namely, the American trade.

Certainly no time should be lost by your manufacturers in making an effort to improve the condition of their goods, so that when you are again confronted with German competition you will at least not feel the disadvantage on account of quality. We are hoping to hear from you at a very early date that your manufacturers are working as a unit, and have adopted a process in producing sulphate of ammonia which can stand side by side with that offered by your Continental competitors. Unless the British manufacturers take immediate steps to improve their product, they will awaken some day to find that they have lost the American trade. This is not theory, but a fact which is actually staring us in the face.

In addition to the above, German sulphate of ammonia, being kiln-dried and granular, can be drilled into the soil the same as a complete fertilizer. This cannot be done with the British make, because it contains moisture and free acid, which would clog up the drills. You can see that this advantage alone in the German make will give that production the preference at even figures. Furthermore, the German make being dry, the sulphate does not adhere to the bags. The free acid having been eliminated, the bags are in perfect condition, thus enabling the importers to resell the bags, realizing anything from 3 c. to 5 c. each. According to some of our friends who have already received the German goods, they report that practically no sulphate is lost through adhesion; whereas shipments of British show a loss anywhere from 3 lbs. to 8 lbs. per bag, in addition to the bag being eaten with acid, thus making it unsaleable.

DR. G. A. JEFFERY, OF EASTBOURNE

Completing his Ninetieth Year.

[From a Correspondent.]

The hand of time has been laid so gently upon the veteran Chairman of the Eastbourne Gas Company (Dr. George Augustus Jeffery, J.P), that many who meet him in public or private life find it difficult to realize that he is completing his ninetieth year; and it may be said of him that the exceptional mental and physical powers which he still enjoys are due in no small degree to the wisdom and prudence with which he has ordered his life. Of course, he inherited a robust constitution; and he has also had the great advantage of residing for upwards of sixty years in one of the healthiest districts of the country. A Cornishman by birth, he still manifests some of the characteristics of the people of that county; and from time to time it has been a source of great happiness to him to visit the West Country and enjoy his favourite sport of angling. But his life has been such a busy one that he has never devoted much time to recreation. He was a very young man when he came to Eastbourne in the fifties; but it was his good fortune to win the confidence and respect of the residents. Besides attending to his private practice, he served for some time as one of the Medical Officers of the Eastbourne Union; and, after resigning his position as an official, he became a member of the Board of Guardians, and acted as Chairman for several years.

In 1857, Dr. Jeffery was elected a Director of the Eastbourne Gas Company. Three years later he became Chairman; and since he has never, one is assured, been absent from the half-yearly meetings, he must have presided at about 110 of them. When the writer visited the office some time ago, the Secretary (Mr. James S. Garrard) drew attention to some admirable photographs, which are interesting from many points of view. One of the pictures was taken on Dec. 5, 1878; and the occurrence was the laying of a commemoration stone after the completion of an important extension of the works. The figures in the group include Dr. Jeffery, the late Mr. R. Insoll, the late Mr. Robert Colgate, the late Mr. Charles Simmons, the late Mr. Thomas Arkcall, Mr. William Guy, and the late Mr. Ben Bradford (Directors), Mr. W. Lumb Wallis, the late Sir John Aird, Mr. J. H. Campion Coles (Secretary), Mr. Alfred Williams (Engineer), and Mr. Isaac Winchester (Works Manager).

On the completion of Dr. Jeffery's fiftieth year of service another photograph was taken; the group including Dr. Jeffery, Alderman J. C. Towner (the Deputy-Chairman), the late Mr. Joseph Farncombe, Mr. Caleb Diplock, Councillor B. Bradford, Mr. C. J. Vinall, the Secretary (Mr. James S. Garrard), the then Resident Engineer and Manager (Mr. John Hammond), and Mr. W. H. Hammond. The large portrait of Dr. Jeffery taken on the same occasion was presented to him by his colleagues; and he handed it back to them, in order that it might be hung in the Board-room.

At the present time, Dr. Jeffery and his co-Directors are called upon to face many difficulties arising from the world-war now being waged. No sooner had hostilities broken out, than the contractors for the supply of coal were released from their contracts, and only offered to continue them subject to a continual increase in the charges. The Company have just received the third notice of advance. In fact, the

price of coal is now such that the production of gas costs 5d. per 1000 cubic feet in excess of the outlay when the war began. The decision of the Directors to raise the price by 2d. per 1000 cubic feet indicated a desire on their part to show the utmost consideration for the public. The consumers have indeed good reason to believe that it is the sincere desire of Dr. Jeffery and all connected with the Company to supply gas at the lowest price; and critics must be reminded of the fact that the sliding-scale renders it inevitable that any serious advance in the charges must involve a decrease in the dividend.

Retiring from practice a good many years ago, Dr. Jeffery left Eastbourne, and went to reside near Hailsham, where he is passing the long evening of a well-spent life in tranquil enjoyment; the other members of the household being his wife, his three daughters, and his son, Mr. F. A. Jeffery. Dr. Jeffery was the Chairman of the Eastbourne Local Board; he served for a short time on the Eastbourne Town Council; and he was for a considerable period an Alderman of the East Sussex County Council. As a Justice of the Peace for the County of Sussex, he is sometimes in the chair at sittings of the Magistrates at Hailsham.

PLYMOUTH CORPORATION BILL.

The Gas, Water, and Electricity Clauses.

A Statutory Meeting of the Ratepayers of Plymouth was held last Friday, with reference to the Bill which the Corporation are promoting in the present session of Parliament.

The Town Clerk (Mr. J. H. Ellis) explained that the Bill was rendered necessary by the amalgamation of Devonport and East Stonehouse with Plymouth, and that its purpose was to consolidate and amend the 119 Local Acts of Parliament now in existence and bring the whole of the local legislation into harmony with the recent practice of Parliament. With reference to the provisions relating to water supply, they enabled the separate undertakings which exist in Plymouth, Stonehouse, and Devonport to be united, and a sum not exceeding £60,000 to be spent on mains for bringing an increased supply from the watershed. The Bill authorized the fixing of a uniform charge for water throughout the unified area. For domestic purposes, the charge would be the old Plymouth rate, with one exception. In Plymouth hitherto there had been no charge above £2 per annum, which was the sum for houses of the yearly value of £80 or more. In Devonport and Stonehouse the scale was continued, and the charges were based on varying percentages where the value exceeded £80 per annum. In future the charges in Devonport and Stonehouse would be reduced to the old Plymouth level in all cases where the yearly value was £80 or less; and above this yearly value there would be a uniform charge of 2 per cent. on the yearly value, which was substantially lower than had been charged in Devonport and Stonehouse. Objection had been taken by the Plymouth Ratepayers' Association to a clause with reference to the charge for trade supplies, and a resolution passed by that body expressed apprehension as to the powers the Corporation would have to make heavy charges for water on premises used jointly for business and domestic purposes, and so cause great injustice to the smaller class of traders. As a matter of fact the Bill did not go beyond the powers possessed by the Corporation under an Act passed in 1867. They could now charge more than they actually did, and more than the maximum put in the present Bill. They had, however, considered it of the utmost importance that water charges should be kept as low as possible for the benefit of the inhabitants, and with a view to attracting business; and no doubt the new Corporation would adopt a similar policy. Under the clause the present slightly higher charges of Devonport and Stonehouse would be reduced to the Plymouth level. If the clause were eliminated, the effect would be that in Old Plymouth they would be able to do exactly as in the past and no one would benefit. With regard to the Devonport gas undertaking, the Bill authorized the Corporation to carry it on without substantial variation, except that the illuminating power of the gas would be reduced to 14 candles in Devonport, as it was now in the area of the Plymouth and Stonehouse Gas Company—the idea being that there should be in the rates, the water, the gas, and everything else equality of treatment throughout the enlarged borough. In this spirit the Bill applied throughout the borough the power which obtained in Devonport and Stonehouse to sell or let for hire electric lamps, meters, fittings, and apparatus for either light or motive power. There was a division of opinion in the Council as to the wisdom of applying this clause in its present form to Plymouth, and it had been passed on the express understanding that the question should be further discussed.

Mr. S. Stephens protested against the proposed charges for water supplied to small traders, and said he saw in the clause an evident desire to get behind the judgment of the House of Lords on this subject. He moved that the clause be omitted.

The motion was defeated, and the former resolution by the Mayor approving the Bill was carried.

Electric Light Failure at New Malden.—A partial failure of the electric light occurred at New Malden on a recent Monday night. People relying solely upon this illuminant found their rooms and offices suddenly plunged into darkness for about twenty minutes. Between seven and eight o'clock, the current again passed along the wires; but later there were two repetitions of the incident, each lasting about five minutes. The Highways Committee of the Maldens and Coombe District Council were sitting at the Municipal Buildings, and they finished their business in candle light. It appears that the failure was due to one of the 1000-kilowatt turbines at the electricity works of the Wimbledon Corporation getting out of order; and this affected practically the whole area.

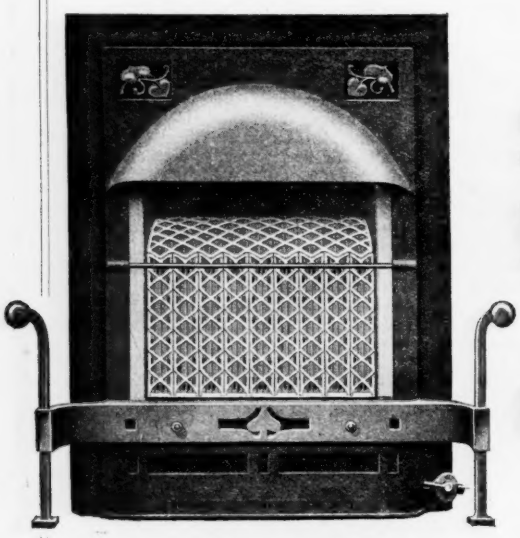
1914—A Retrospect.

The "Journal of Gas Lighting," in its retrospect of 1914, says:

"Another advance has been invention to secure the MORE Silent Operation of Gas Fires."

Eliminate the word "MORE"—and the statement is applicable only to the

WILSON "SOLA" GAS FIRES.



The "ASTOR."
One of the Really Silent Gas Fires.

WILSON'S are the Inventors and Originators of the

REALLY SILENT GAS FIRE.

WITHOUT NOISE AND :: ::
WITH KEEN HOT FLAMES.

WILSONS & MATHIESONS, LTD.,
Carlton Works, Armley, Leeds.

London Show-Rooms:
76, Queen Street,
Cheapside, E.C.

INCREASED GAS OUTPUT IN MANCHESTER.

Effect of the War on the Consumption.

In a report dated the 31st ult., Mr. Fred. A. Price, the Superintendent of the Manchester Corporation Gas Department, made the following statement with regard to the consumption of gas during the nine months to that date.

Notwithstanding that the country has been at war for five months, the consumption of gas in the nine months ended Dec. 31, 1914, shows an increase of 3·11 per cent. over the corresponding period of 1913, when an increase of 2·85 per cent. over 1912 was recorded.

This satisfactory result is no doubt owing to the increased use of gas for cooking and heating, and to an increase of 2495 in the number of consumers. We have now 189,600 consumers of gas; and there are 7145 more cookers, 2019 more grillers, and 5300 more fires in use at December, 1914, than there were at December, 1913. The totals of each description of apparatus in use at date are as follows:

Cookers	78,970
Grillers	36,174
Fires	16,061

It is interesting to point out that, in the four months preceding the declaration of war, the increase was 6·17 per cent., and in the five succeeding months the increase is only 1·31 per cent.—showing that the war has undoubtedly had some effect on the consumption. However, in December we had the record consumption in 24 hours of 29,690,000 cubic feet, and a record week's consumption of 178,195,000 cubic feet.

PROGRESS IN BIRMINGHAM.

Prices of Residuals.

The proceedings at the first meeting of the Birmingham City Council for this year—which was held last Tuesday—included reports from five Committees, one of which was the Gas Committee. The meeting was presided over by the LORD MAYOR (Alderman Bowater).

Alderman Sir HALLEWELL ROGERS presented the report of the Gas Committee, and referred to the paragraph in it: "Contracts have been placed for the supplies of coal and gas oil for the year ending June 30 next at slightly more favourable prices than those of the previous year." The wording of this, he said, might lead the Council to expect a better financial result from the Gas Department than last year. He would point out that, though they were enabled last year to buy coal and oil at a lower price than in the previous year, the full effect of the reduction in price would not be felt in the financial year ending in March next, as their contracts for both coal and gas oil at the old prices ran well into the present financial year. He might also mention that since the railway strike in August, 1911, it had been the policy of the department to hold very much larger stocks of coal and oil than previously, as a precautionary measure. During the past year these, unfortunately, had had to be laid down at the higher prices which obtained. Then, with the growth of the undertaking, which had been considerable lately, their general floating stocks had, naturally, been increased. The Committee felt that this policy was absolutely necessary in the interests of the city; and the Council would realize that the carrying of these larger stocks entailed a considerable financial burden on the department, the amount of capital so locked-up being several hundreds of thousands of pounds more than it was three or four years ago. The interest on this amount was a very serious item. The position was also considerably affected by the poor results from residuals. The prices obtained for coke, tar, and ammoniacal liquor were very much lower than in previous years. The effect of the war on these markets had been particularly pronounced; and though the consumption of gas over the year would, he was glad to say, show an increase over the preceding year, the net result of the year's working at the end of March next would, he was afraid, mean a considerably reduced contribution in aid of the rates. It was, of course, too early to give any definite figures of possible profits; but the Committee were looking carefully into the matter. A very good response had been made by the employees of the department to the nation's appeal for men. Up to the present 535 officials and workmen, including the Secretary and Manager, had joined the Colours. To fill most of the positions vacated, it had been necessary to employ temporary help; and this, of course, entailed an additional charge on the department. It would probably amount to about £15,000 or £16,000 per annum. He wished to testify to the loyalty of the staff left behind, which was shown in their willingness to carry on, as far as possible, the duties of those who had enlisted. In many cases this entailed increased reeponsibilities and longer hours; but the work was done without any expectation of reward. The progress of the department continued to be well maintained. Although for a few weeks after the outbreak of war there was a slight decrease in the consumption of gas, this falling off proved only temporary, and the output gradually increased until in the third week in October it exceeded last year's figure by 6 million cubic feet. Good increases were also reported for the months of November and December. In fact, during the two weeks before Christmas all previous records were beaten; the outputs for the weeks ended Dec. 16 and 23 being 268½ and 281½ million cubic feet respectively, as compared with the previous maximum weekly output, which took place in January of last year, of 267½ million cubic feet. The maximum daily output had also been exceeded on three occasions; and the record in this respect—approximately 46⅓ million cubic feet—was reached on the Wednesday before Christmas. These figures were an indication of the improved state of trade in the city; but probably the improvement would be only temporary. The increased output was, no doubt, largely due

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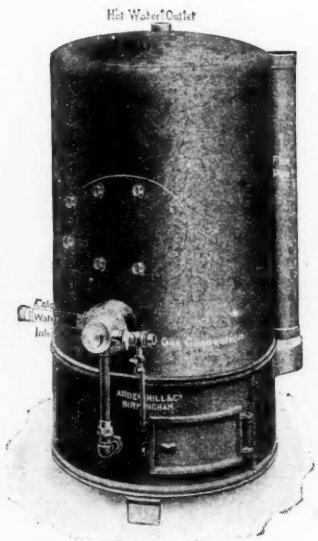

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to the greater number of gas-fires and heating stoves now used throughout the area of supply; and this formed a permanent source of income. At a low estimate, if the gas-fires at present in use were burned an additional hour per day it would mean an extra 7 million cubic feet consumed in one week. The increase, up to date, compared with last year's output, was approximately 3¾ per cent., which, in the circumstances, was very satisfactory.

Mr. DUGGAN said when the estimates were before them the question of the sale of bye-products came under discussion; and in reply Sir Hallewell Rogers said the Committee were considering the advisability of starting to work-up their own products. He (Mr. Duggan) understood Sir Hallewell promised to present a report on the subject. It appeared that the matter had been discussed by the Committee, and apparently the proposal was not considered advisable. Would Sir Hallewell have a report printed and circulated, giving the information upon which their conclusion was founded?

Mr. SAUNDERS asked how many of the vacancies caused by the employees joining the Colours had been filled. Were the Committee in favour of filling all the vacancies, or of relying upon the present staff to do extra work during overtime?

Mr. ROSE asked if the Committee did not think the services of a gentleman drawing the salary Mr. Hilton did would be more valuable in the city than at the front.

Mr. STEVENS said he was rather astonished to hear this remark. He wished to state that it was Mr. Hilton's own desire that he should go: and he (Mr. Stevens) admired him for it. He was a patriot, a man of courage. No attempt was made by the Committee to restrain him.

Sir HALLEWELL ROGERS, in reply, said Mr. Hilton asked to be allowed to go; and the Committee felt that, owing to his previous training, he would be able to do excellent work, and they could not say him nay. His place had not been filled; but the Assistant Secretaries were doing all they could. As to other questions, it was difficult to get workpeople; and, therefore, overtime must be resorted to. On the staff, they had filled all the vacancies they could. If the Council so desired, he would at some future time present a report as to the advisability of working-up their own bye-products.

The report was then approved.

BLACKBURN GAS ENGINEERSHIP.

Mr. Ogden Voted a Thousand Pounds.

By an overwhelming majority, the Blackburn Town Council last Thursday voted Mr. Samuel R. Ogden, the retiring Gas Engineer and Manager, £1000 (that is, two years' full salary), in recognition of past services.

Mr. Ogden has, as stated in the "JOURNAL" last week [p. 38], been in the service of the Corporation for thirty years, and for 21 years has held the position of Gas Engineer. Last year there was a seven weeks' strike of gas-workers; and the sequel to the dispute was a report on the undertaking by Sir Corbet Woodall, D.Sc. On consideration of this report, a Special Sub-Committee came to the conclusion that the first step in the re-organization of the department should be a change in the management. On this opinion being communicated to Mr. Ogden, he sent in his resignation.

During the discussion in the Town Council, Sir Edward Hamer protested against the way in which Mr. Ogden had been treated. It was stated that the reorganization scheme will cost between £80,000 and £100,000.

WIGAN CORPORATION GAS UNDERTAKING.

Suggested Consultation of an Expert.

At the Meeting of the Wigan Town Council last Wednesday, Alderman Angus, in moving the adoption of the minutes of the Gas Committee, said he thought the Council were entitled to some explanation with regard to the minute dealing with mechanical stoking being referred back at the last Council meeting. There was nothing underlying the reason of its being taken back. The Committee went fully into the matter, and before doing anything decided to have a report from the Gas Engineer on the whole undertaking. The previous day the Committee held a special meeting to consider the Engineer's report, which they passed as highly satisfactory, and decided that before any money should be spent upon alterations, or any serious change made, an expert should be called in to consider the report and the undertaking generally. Before going into the question of spending any great amount, the Committee wished to feel that they were on safe ground. The present governors were put down in 1876 with only a certain amount of surplus pressure, and they had lasted up to the present time, though not without grumbling of late years; and when they came to consider that the consumption of gas had increased to the extent of something like 200 per cent., they would readily agree that something would have to be done. Mr. J. Lowe suggested that the minutes should be passed with the exception of the Engineer's report, so that the latter could be considered in detail by the members of the Council, who had only just received it. Mr. Roscoe said it was the wish of the Committee that the report should go through, and that there should be no delay. The Mayor (Alderman J. T. Grimshaw) said the only question of any importance was the fee that would have to be paid to the expert. Probably a General Purposes Committee meeting would be held later to discuss the whole question and get on a proper basis. Mr. Fletcher said he was inclined to think the present was a very opportune time for the whole undertaking to go before an expert; and he considered the minutes ought to be passed, so that one could be obtained. The minutes were confirmed.

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ILKESTON GAS-WORKS RECONSTRUCTION.

An echo of the trouble which occurred at Ilkeston three years ago, when the new spirally-guided gasholder was demolished, was heard at the meeting of the Town Council last Tuesday, when some particulars were forthcoming as to the cost of the reinstatement of the works. The subject—a fruitful theme of controversy—again engendered some heat, and a certain undignified episode marred the proceedings.

The MAYOR (Councillor Macdonald), in moving the adoption of the Gas Committee's report, explained that the actual expenditure involved upon the reinstatement of the works had been £7341, against the estimate of £7501. This he thought afforded evidence of the care with which the estimates were prepared, and the way in which the Committee, assisted by the Town Clerk, dealt with them. They had underspent by something like £160, and the gas-works were now in an excellent state of efficiency.

Mr. W. SMITH moved, as an amendment, the omission from the report of reference to satisfaction at the accuracy of the original estimate. What, he asked, was the satisfaction to be felt about the No. 1 holder when the contract was let a month before the estimate was prepared. No. 2 holder cost £12 less than the estimate; but was there anything marvellous in this, seeing that the contract was obtained six months before the estimate? The new brick and puddle tank cost a few pounds less; but here again the contract was let a month before. To ask the Council to express their satisfaction that the expenditure was so near to the estimate was, in the circumstances, all "rot." It was done with the idea of showing that the reinstatement of the gasholder had come out much better than was expected. It was no such thing; and he queried whether they had got such an excellent bargain after all. They had a second-hand holder which was not so good as a new one. It originally cost £2708, and two or three years afterwards was reconstructed—70 to 80 per cent. of the old material being used—at a cost of £2708. Where did the good bargain come in? Were they justified in letting the work of reconstruction without contract? They did not know how the money had been spent, and who had been attending to their interests.

Mr. CHADWICK pointed out that the newly constructed holder had been placed in a brick and puddle tank to secure its safety, in contrast with the former arrangement of a steel tank which gave way.

Mr. SMITH: The holder is the same holder restored, and there is no question here of the tank.

Mr. E. SMITH, in seconding the amendment, said he was reminded of the part which the Mayor had taken in this disastrous affair from the beginning up to the present.

The MAYOR said that, while there was not much to reply to upon the general discussion, he wished it to be clearly understood that he was not going to tolerate any impertinence from Mr. Smith.

Mr. W. SMITH: Neither am I going to stand speeches from you. I do not want prattle.

The MAYOR said that so long as he was Mayor he would insist upon the debates being conducted with fitting decorum.

Here ensued an altercation between the Mayor and the mover and seconder of the amendment. The Mayor called for an apology, which was not made; and eventually he, accompanied by several aldermen and councillors, retired. Upon their return, after the stated period, the request for an apology was not reiterated, and the business was resumed, after the Mayor had expressed the hope that there would be an absence of further scenes. Upon the general question as to the action he had taken regarding the reinstatement of the gas-works, his Worship added that he entertained no regrets.

The amendment was negatived, and the Gas Committee's report was adopted.

ENEMY PATENT RIGHTS.

List of British Patents Granted to Germans and Austrians.

By virtue of the provisions of the Patents, Designs, and Trade Marks (Temporary Rules) Act, 1914, any person may apply to have any of the hereunder patents revoked or suspended, providing that such person applying can satisfy the Board, or any person whom they may appoint for the purpose, that the patentee or licensee is the subject of a state at war with His Majesty, that such person applying intends to manufacture, and that such revocation is in the general interests of the country or of a trade. The list is contributed by Messrs. Hughes and Young, Patent Agents, of 55 and 56, Chancery Lane, W.C., who will furnish readers with any further information they may require.

2281 (1913).—BERLIN ANHALTISCHE MASCHINENBAU, "Gas-mixing appliances."
2597 (1913).—H. M. LIESE, "Fluid-meters."
3035 (1913).—F. C. W. TIMM, "Gas-producers."
3672 (1913).—F. C. W. TIMM, "Gas-generators."
3948 (1913).—HAPPEL, "Filters for gaseous fluids."
5108 (1913).—H. REHMAN, "Gas-producers."

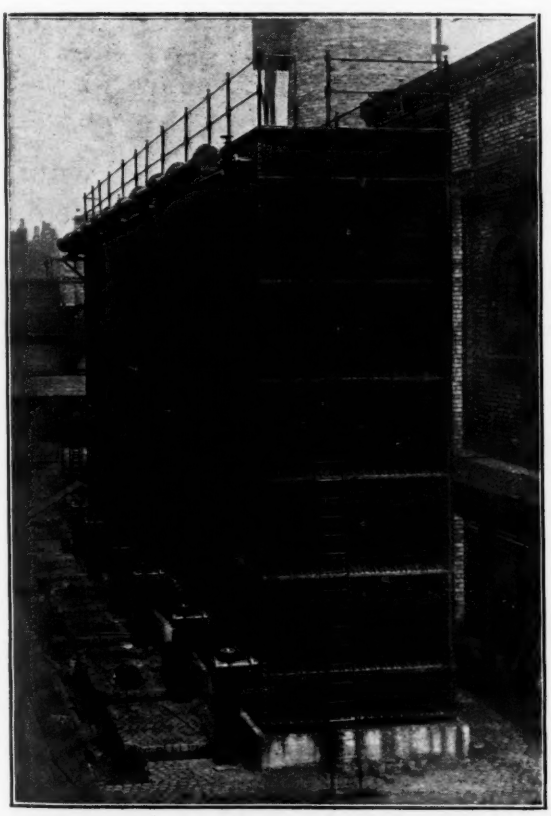
CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan.* 11.

There is little of interest to report as to the tar products market during the past week. The scarcity of steamers and the high freights indicated make shipments of pitch very difficult. Creosote is in good request, and the value is $4\frac{1}{16}$d. net at makers' works.

Sulphate of ammonia is further advancing in value, and quotations



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vary from £11 15s. to £12 net for prompt for 25 per cent. quality in buyers' bags at makers' works; while £11 12s. 6d. has been paid for large quantities on the same conditions for July-December next.

Tar Products in the Provinces.

Jan. 11.

The markets for tar products have remained steady throughout the past week. In benzol, the price remains about the same, but not very much new business has been reported. Toluol keeps steady. There is a fair demand for this article, and some very good prices are stated to have been paid. Creosote appears to be a little quieter, though there is practically no alteration in the price. Crude carbolic is firm, and sales are being made in the neighbourhood of 2s. 11d. to 3s. per gallon, according to position of delivery.

The average values during the week were: Value of liquid products in one ton of tar, 17s. to 18s. 6d. Benzol, 90 per cent., naked, North, 8½d. to 9d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. to 2s. 4d. Crude naphtha, in bulk, North, 5½d. to 5⅝d. Solvent naphtha, naked, North, 11d. to 11½d. Heavy naphtha, naked, North, 11d. to 1s. Creosote, in bulk, North, 3⅜d. to 3 7/16d. Heavy oils, in bulk, 4d. to 4½d. Carbolic acid, casks included, 60 per cent., East and West coasts, 2s. 11d. to 3s. Naphthalene, £6 to £11; salts, 65s., bags included. Anthracene, "A" quality, 2d. per unit; "B," nominally ¾d.

Sulphate of Ammonia in the Provinces.

Liverpool, *Jan.* 9.

Throughout the week the market for this article has shown no sign of weakening in any position, and once more a substantial advance in prices has taken place. The nearest values at the close are £12 10s. per ton f.o.b. Hull, £12 12s. 6d. f.o.b. Liverpool, and £12 15s. f.o.b. Leith. There has been renewed interest in the forward position, and manufacturers report having sold f.o.b. best ports at £12 15s. per ton for January-June delivery, and £12 7s. 6d. for July-December.

Nitrate of Soda.

This market is a little firmer, and holders on spot now require 10s. 1½d. per cwt. for ordinary, and 10s. 7½d. for refined quality.

Sulphate of Ammonia.

From another source it is reported that this market has been very firm throughout the past week, and prices have again risen. Outside London, makes are quoted at £11 12s. 6d. to £11 15s.; Hull, £12 6s. 3d. to £12 7s. 6d.; Liverpool, £12 8s. 9d. to £12 10s.; Leith, £12 10s.; Middlesbrough, £12 8s. 9d. to £12 10s.

COAL TRADE REPORT.

Northern Coal Trade.

There is more activity in the coal trade, and the shipments are heavier. Steamers have been more plentiful, and exports of coal to France and Italy are fuller, though the rates of freight are very high—over 23s. per ton being paid for coal, Tyne to Genoa. In the steam coal trade, best Northumbrians are steady at 13s. 6d. per ton f.o.b.; seconds are about 11s. per ton; and steam smalls are 7s. 3d. to 8s. 9d. per ton f.o.b. There are some Government contracts in the market for steam coals. In the gas coal trade, rather better consumptive demand shows itself; and there is a fair output at many of the Durban collieries. Best Durham gas coals are firm at 12s. 6d. per ton f.o.b.; second-class kinds are unaltered at 11s. per ton; and "Wear Specials" are in good demand at 13s. per ton f.o.b. There appears to be a better forward demand for gas coal, and the producers are apparently inclined to ask higher prices for some qualities in such cases. On the other hand, buyers have to take into account the fact that the delivered prices now include very high rates of freight—in some instances more than double those that were paid six months or so ago. There is also a lack of miners owing to the large amount of recruiting on Tyneside; and this affects the production and the price of coal. Coke is steady, with a good demand. Gas coke is plentiful, and varies more in quotation—perhaps 11s. 6d. being a medium f.o.b. figure.

Wokingham Gas-Works Extensions.—At the meeting of the Wokingham Town Council last Thursday, a report was received from the Gas Committee in which it was stated that they had obtained the sanction of the Local Government Board to the borrowing of various sums, amounting to £3150, for gas-works purposes.

Street Lighting at Dudley.—The Dudley Town Council have completed arrangements for the lighting of the gas street lamps in the borough on what are considered very satisfactory terms. The Cradley Heath Gas Company will charge, for one-light lamps, £3 10s. per annum, and the Brierley Hill Gas Company £3. The agreements are to be entered into at the cost of the Companies, who have been induced to reduce their charges for gas.

Ashburton Gas Supply.—It was reported at a meeting of the Ashburton District Council on Thursday that, owing to the railway congestion and other difficulties arising from the war, great trouble had occurred with reference to the supply of coal for the gas-works. At the same time, there was an unusual demand for gas; and the Gas Committee had been requested by the military authorities to instal gas stoves and radiators for the use of troops to be quartered in the town. As in these circumstances there was a shortage of gas, the Committee decided that the arrangements for public lighting should be left to the Chairman of the Lighting Committee and the Gas Manager, who will be guided by circumstances.

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Leeds Gas-Works Re-Organization Scheme.

The Leeds Non-Political Ratepayers' Association have written to the Lord Mayor in respect to the proposed scheme for the re-organization of the gas-works, urging that during the war all such schemes should be so arranged that the aggregate sum spent during the year on capital account should not exceed the amount of the total sinking fund set aside for the year, in order that the Corporation should not hamper the Government by competing for the "silver bullets," and also tend to raise the general rate of interest on Corporation loans. The scheme, it is held, appears sound and practical; but it does not include the treatment of the Corporation's own residuals. It is contended that this would give a wider and more profitable outlet for the bye-products, and would secure a better chance for cheapening gas, which, it may be assumed, would lead to greater consumption. It is also urged that the competition between the two Corporation lighting undertakings should cease, and their spheres of activity be more strictly defined. At premises which are fitted with gas or electricity only, no canvassing should be allowed by either department to secure a change.

Illuminating Power of Gas in Canada.—The gas inspectors of the Canadian Inland Revenue Department found some remarkable conditions in certain Canadian cities, according to the annual report of the department lately issued. In regard to illuminating power, 21 tests out of 23 in Victoria (B.C.) showed the gas to be below the standard. In Winnipeg, 75 out of 102 tests were below; in Ottawa, 26 out of 82 tests were the same. In Toronto, Montreal, St. John, and the majority of the other cities and towns, however, the gas was up to the standard of illuminating power.

Birmingham Girl Asphyxiated.—An inquiry was held last Thursday, at the Victoria Courts, Birmingham, as to the death of Mabel Speerli, aged eight, whose body was found on Monday last week at the house in which she resided with her father. Acting upon information received in a note signed "Robert Speerli," the police visited the house, and in an upstairs room the girl was lying in bed dead. A note was discovered, and from a statement it contained it is alleged that Speerli had attached a rubber tube to the gas-jet, placed one end to his daughter's mouth while she was asleep, and then turned on the gas. The girl had not been seen since about five o'clock on the preceding Saturday. At the Birmingham Police Court, on Tuesday, Speerli was charged with the crime, and was remanded. He was present at the inquest. A police-constable stated that when Speerli was arrested he mumbled something unintelligible, and at the station said he had had a lot of trouble and had caused the death of his child. He added that she had been ill, and he thought she would be better off. Medical evidence was given to the effect that deceased died from asphyxia, the result of poisoning by coal gas; and the Jury returned a verdict of "Wilful murder" against Speerli, who was committed for trial at the Assizes.

Preferential Electricity Charge Litigation.—No doubt as a result of the recent legal decisions adverse to preferential charges for electricity, the Bridgwater and District Electricity Company, Limited, intimate that it has "been decided to reduce the flat-rate of 4½d. per unit to 4d. per unit to all consumers of electricity for lighting purposes. No further rebate or discount will be allowed." The former price was 4d. per unit if electricity was used exclusively, and 4½d. per unit if any gas was consumed.

Kirkby-in-Ashfield Gas-Works Extensions.—The rapid growth of townships through the development of mining enterprise in the Leen Valley of Nottinghamshire has of late been most marked. Further evidence is afforded by the necessity for gas-works extensions at Kirkby-in-Ashfield, near Mansfield; it being reported at the meeting of the Urban District Council last Tuesday that sanction had been received from the Local Government Board for the borrowing of £5500 for the provision of a new gasholder, &c.

Increased Price of Gas at Eastbourne.—The Eastbourne Town Council have appointed a Committee to report (after full consideration and discussion with the Gas Company) upon an intimation by the Directors that there is to be an increase of 2d. per 1000 cubic feet in the price of gas. The Mayor (Mr. C. W. Bolton) said this was an addition of practically 7 per cent. to the charge, and was an important matter to the ratepayers and Corporation. Alderman Towner, who said he was a shareholder of the Company, observed that if things went on as now, there would not be any gas at all in twelve months. The harbour at Newhaven, where the coal was delivered, had been closed; and the Company could not even get trucks. He thought the Mayor's suggestion was most ridiculous. The Mayor answered that the Town Clerk and himself had discussed the subject, and thought a Committee should be appointed to consider it.

Rights of Parish Councillors.—A matter involving a point of some importance as affecting the rights of parish councillors to approach local gas companies without the authority of the bodies of which they are members, arose at the last meeting of the Sandiacre (Derbyshire) Parish Council, when a letter was read from the Manager and Secretary of the Long Eaton Gas Company (Mr. George Stevenson) respecting visits paid to the Company's offices by Councillor Dawson, for which, it was stated, he had been previously censured by the Council. In the course of an acrimonious debate, Mr. Dawson avowed that he had never approached the Gas Company on subjects affecting the Council, apart from a small question relating to insurance. Strong exception being taken to any councillor acting without direct authority, Mr. Dawson explained that his visits were made before any agreement was arrived at with the Company on the gas question. He said he had been charged with interfering; and he threatened to take other steps if the charges were not withdrawn. The discussion ended with a declaration by Councillor Parker that the accusation, to which they adhered, was that Mr. Dawson had, without any right, been to the Long Eaton Gas Company on Council business.

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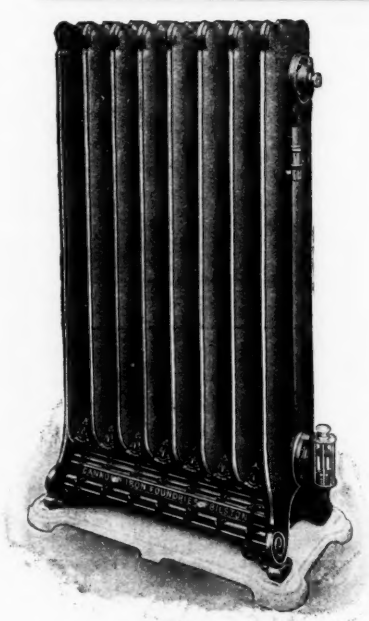

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Increase in the Price of Gas at Oxford.—The Secretary of the Oxford Gas Company (Mr. Frank Gray) has informed the Town Clerk that he has given public notice that after the reading of the meters by the Company for the December quarter the price of gas will be 2s. 4d. per 1000 cubic feet within, and 2s. 10d. beyond, the district of the Corporation.

Gas Explosion in Belfast.—A gas explosion occurred last week in a house at Belfast occupied by Mr. C. Stevenson and his family. There had been a smell of gas, and Mr. Stevenson turned off the supply at the meter and opened the front door and windows, to let the gas escape. After waiting for about ten minutes, he approached the meter-box with a lighted candle and made an examination, finding everything in order. Just as he was leaving the room, there was a big explosion beneath the flooring. Mr. Stevenson and his wife and daughter were all to some extent hurt, and furniture was smashed.

Salisbury Gas Supply under Flood Conditions.—Mr. Norton H. Humphrys, of Salisbury, sends a local paper giving a graphic account of the district troubles through recent rain floods. As to the effect on the gas supply of the place, it is remarked that there was no serious interference with operations at the gas-works, although some inconvenience was caused by water getting into the retort-house cellars. But when the usual evening supply was turned on at dusk last Tuesday it was found that the leading main pipe from the gas-works to the Park district was waterlogged, and no gas would pass. Along Middleton Road there was some 6 or 7 feet of water, which entered the houses, and strained some of the meter joints to a sufficient extent to allow water to leak into the main by way of the house supply pipes. Consequently great inconvenience was occasioned in the district on Tuesday evening, as nothing could be done till daylight. The supply was greatly reduced; but all the public lights remained alight. Early on Wednesday morning jack boots were requisitioned, and the supply set right in time for the usual cooking demand. Several public lamps in the flooded localities were burning all day—being surrounded with water, so that the men could not get to them.

Torpoint Public Lighting.—Tenders for the lighting of the streets were considered by the Torpoint Urban District Council last Thursday. The Gas Company offered to light the town at £1 19s. 6d. per 100-candle power lamp per annum, or, alternatively, to supply gas at 3s. 9d. per 1000 cubic feet. Owing to the upward tendency of coal prices, the Company made it a condition that the contract should hold good only so long as the cost of coal delivered in their yard did not exceed £1 3s. per ton. The Electricity Supply Company's tender was for £2 2s. per annum per lamp of 1000-candle power, or 3d. per unit if supplied by meter. According to the Surveyor's calculation, the actual cost of the lighting, including incidental charges, would amount to £2 16s. 2d. per lamp for gas and £2 17s. per lamp for electricity. The Council decided to accept the tender for electric lighting at £2 2s. per lamp.

Professor Boys on Illumination by Gas.—The course of lectures to young people on "Science in the Home" which Professor C. Vernon Boys, F.R.S., has been delivering at the Royal Institution, was brought to a close last Saturday afternoon, when the lecturer dealt with the subject of lighting. He called attention to the fact that it was just a century since Fleet Street was first lighted by gas. With the old flat-flame burner it took, he said, one cubic foot of gas to produce the lighting power of one candle. In the case of the high-pressure lamps employed in the neighbourhood of Whitehall before the war, one cubic foot of gas produced no less than 60-candle power. The future of street illumination lay, in the lecturer's opinion, between this light and the half-watt electric lamp. With regard to the interior illumination of dwelling-houses, it had to be admitted that incandescent lamps had brought about a wonderful revolution. From a burner fitted with the upright mantle, six times as much light was obtained by its assistance as could be done without it. But there were two objections to the mantle, apart from the obvious one of its fragility. Firstly, it cast a shadow upon the table beneath; and, secondly, it was impossible to prevent dust from falling upon the delicate crown of the mantle and clogging all the gas passages. The inverted mantle, however, overcame both difficulties.

GAS COMPANIES IN THE STOCK EXCHANGE.

The London Stock Exchange was duly reopened on Monday, the 4th inst., and a very large number of members were early in attendance to witness the historic event. After the National Anthem had been sung, business began. Starting slowly and cautiously at first, it gradually developed pace and power, and, what is more, it evinced a thoroughly favourable tendency. Instead of pressure to sell, the move was all the other way; and buyers eager to pick up bargains at war prices were in force. This good tone continued throughout the week. But—as was only to be expected—the strange and novel conditions gave rise to difficulties of procedure not contemplated or foreseen; and these to some extent hindered the volume of business done from attaining remarkable magnitude. These impediments will no doubt soon be surmounted.

A few words will perhaps be regarded as necessary to explain the recasting of our table of quotations below. There are no longer any "official prices," but "official minimum prices" of stocks and shares. In gas securities there are only two which have minimum prices—viz., Metropolitan of Melbourne 4½ per cent. debentures, the minimum price of which has been fixed at 99, and Liverpool 4 per cent. debenture stock, the minimum price of which is 97. It may be noted that not all the Provincial Exchanges appear to have had time to get into step with London in regard to quotations. In the circumstances, therefore, we give in the table the last "official prices" ruling on July 30 and the yield upon investment as a standard for comparison, with the "bargains done for cash" shown in the last column. This arrangement will be varied as and when developments of business on the Exchange render it possible.

The bargains in gas securities that were officially recorded during the week were as follows: On Monday Gas Light ordinary 87, ditto maximum 70¼; South Metropolitan 100¼, 101½, 102, 103. On Tuesday, Hornsey 165, Oriental 118, and Primitiva 5⅛. On Wednesday, Gas Light ordinary 88½, Primitiva 5, ditto preference 4½, 4$\frac{11}{16}$, 4$\frac{11}{16}$, 4¾, South Metropolitan 101½, 101½, 102, 102½, ditto debenture 70. On Thursday, Gas Light ordinary 87⅞, ditto preference 93½, South Metropolitan 101½, South Suburban 109. On Friday, Gas Light ordinary 87½, 88½, 88½, 89, 89¼, ditto maximum 74, Imperial Continental 83, 84, South Metropolitan 101½, ditto debenture 70¼. On Saturday, Commercial 3½ per cent., 97¼, Gas Light ordinary 88, 88½, 89, 89¼, ditto maximum 70¼, ditto preference 93½, Imperial Continental 81, 81½, South Metropolitan 101, 102, South Suburban 108.

Bank rate (fixed Aug. 8) 5 per cent.; last year 4½ per cent.

LOWEST AND HIGHEST PRICES OF BARGAINS DONE FOR CASH IN THE WEEK ENDING JANUARY 9.

Issue.	Share.	When Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30.	Yield on Lowest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.			£ s. d.	
1,551,868	Stk.	April 8	2½	Alliance & Dublin Ord.	59—64	3 18 2	..
374,000	,,	July 10	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	Bombay, Ltd.	5⅞—6⅜	5 17 8	..
50,030	10	Feb. 26	16	Bournemouth Gas & Water: 10 p.c.	29—30	5 6 8	..
873,480	10	,,	7	Do. B 7 p.c.	15—15½	4 10 4	..
95,000	10	,,	6	Do. Pref. 6 p.c.	13½—14	4 5 9	13½—13⅝
880,000	Stk.	Feb. 26	14	Brentford Consolidated	261—266	5 5 3	..
330,000	,,	,,	11	Do. New	204—209	5 5 3	..
58,000	,,	,,	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	,,	June 11	4	Do. 4 p.c. Deb.	91—98	4 6 0	..
217,880	Stk.	Feb. 26	11	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	,,	,,	8	Do. A Ord. Stk.	154—159	5 0 8	113—145
530,000	20	Mar. 26	12½	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	Cape Town & Dis., Ltd.	1⅞—2⅛	—	..
100,000	10	—	—	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106—108	5 1 2	..
560,000	,,	,,	5½	Do. 3½ p.c. do.	103—105	5 1 6	97½
475,000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
800 000	Stk.	,,	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	,,	,,	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
—	—	—	—	Croydon B 7 p.c.	..	—	220
492,270	Stk.	—	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	European, Ltd.	17⅛—18*	5 11 1	..
16,362,910	Stk.	Feb. 12	4/17/4	Gas Light and Coke: 4 p.c. Ord.	98—102	4 15 6	87—89½
2,600,000	,,	,,	8½	Do. 8½ p.c. max.	76—79	4 8 7	70½—74
4,062,235	,,	,,	4	Do. 4 p.c. Con. Pref.	96—99	4 0 10	95½
4,674,850	,,	June 11	3	Do. 3 p.c. Con. Deb	73¼—74½	4 0 6	..
258,740	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	Hongkong & China, Ltd	16½—16⅞	6 11 4	..
—	—	—	—	Hornsey 7 p.c.	..	—	165
131,000	Stk.	Mar. 12	7½†	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6½†	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	Imperial Continental	150—160	5 12 6	81—84
1,235,000	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	Liverpool United A	211—213	4 13 11	..
718,100	,,	,,	7	Do. B	146—148	4 14 7	..
306,083	,,	June 26	4	Do. Deb. Stk.	97—99	4 0 10	..

Issue.	Share.	When Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30.	Yield on Lowest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.			£ s. d.	
75,000	5	June 11	6	Malta & Mediterranean	4¼—4⅝	6 9 9	..
250,000	100	April 1	4½	Met. of Melbourne: 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	Monte Video, Ltd.	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	Oriental, Ltd.	117—122	6 11 2	118
60,000	5	Mar. 26	10	Ottoman, Ltd.	7⅛—7⅜	6 9 0	..
60,000	50	Feb. 26	13	Portsea, Island B	128—131	4 19 3	..
100,000	50	,,	12	Do. C	118—121	4 19 2	..
249,980	5	April 29	8	Primitiva Ord.	5⅛—6	6 13 4	5—5⅜
499,960	5	June 26	5	,, 5 p.c. Pref.	4⅞—5	5 0 0	4⅞—4¾
521,600	100	June 2	4	,, 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	,, ,, 1911	..	—	85
346,198	Stk.	June 26	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	San Paulo: 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	Sheffield A	223—224	4 9 3	..
209,984	,,	,,	10	Do. B	222—224	4 9 3	..
523,500	,,	,,	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	South African	10⅞—11⅛	7 16 6	..
6,429,895	Stk.	Feb. 12	5/9/4	South Met., 4 p.c. Ord.	111—113	4 16 8	100½—103
1,895,445	,,	July 10	8	Do. 3 p.c. Deb.	72¾—74½	4 0 6	70—70½
209,820	Stk.	Feb. 26	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	108—109
60,000	,,	,,	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
137,058	,,	June 26	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½†	Tottenham and District: A 5 p.c.	135—138	5 8 8	..
742,275	,,	,,	6†	B 3½ p.c.	115—117	5 2 7	..
181,255	,,	June 26	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
				Wandsworth, Wimbledon, and Epsom—			
30,000	Stk.	Feb. 26	8⅜	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6⅜	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/3	,, C 3½ p.c.	110—115	5 2 0	..
352,000	,,	,,	6⅜	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6⅜	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

At the meeting of the Barrow Town Council on Monday last week, contracts were let for new gas-works to the amount of £36,000.

The Directors of the European Gas Company have declared an interim dividend of 5 per cent. (10s. per share), free of British tax, but less 6d. for French duty. The dividend was at the same rate a year ago.

There were fifty applicants for the position of Gas Engineer and Manager at Strabane (co. Tyrone), and Mr. R. J. Skinner, of Londonderry, was called into consultation by the Urban District Council. Ultimately the Council decided to appoint Mr. H. C. Gripton, of Windsor, subject to an interview with him.

The staff of Mr. E. L. Burton (the Secretary of the Brighton and Hove Gas Company, and many other companies connected with the industry) were entertained by him on Saturday evening, the 2nd inst., at the Holborn Restaurant, at a dinner given in honour of several members of the staff who have joined the Forces.

Readers have doubtless seen, from announcements in our advertisement columns, that Messrs. A. & W. Richards will offer for sale at the Mart, Tokenhouse Yard, E.C., next Tuesday, by order of Directors, new issues of shares and stock of the Ascot, Bournemouth, Broadstairs, and Worthing Gas Companies; and, under instructions from other owners, a small parcel of £10 ordinary shares in the Colombo Gas and Water Company, Limited.

According to a paragraph under the heading of "Industrial Notes" in the "Iron and Coal Trades Review" last Friday, the Dover Gas Company and the Electricity Department are now using a considerable quantity of Kent coal, with results which are stated to be satisfactory. The Snowdown Colliery is raising something over 2000 tons a week from the Beresford seam; but the East Kent Colliery at Tilmanstone is only producing some 400 tons weekly, and this is the best that can be done until the reconstruction scheme has been settled. At their adjourned meeting, the creditors of the East Kent Contract and Financial Company, Limited, which was established mainly for financing the sinkings and equipment of the Kent Coal Concessions group of pits, decided to come into line with the creditors of the other seven companies of the group, and agreed to a postponement of payment of their debts until six months after the termination of the war.

Mr. H. White-Thompson has, in consequence of the war, severed his connection with Messrs. Henry Hill and Co., Limited, of Berlin, the makers of the "Hill" mantles; and, in connection with his new arrangements, he has found it necessary to adopt a similar course with regard to Messrs. Oglesby and Ayton, of St. Dunstan's Hill. Mr. White-Thompson has now taken up a position with Messrs. Joseph T. Robin, Limited, whose gas-mantle works are in Greyhound Lane, Streatham, S.W.

APPLICATIONS FOR LETTERS PATENT.

24,426.—Gill, G. M., Donald, D. B., and Jenkinson, W., "Declinkering machines." Dec. 21.
24,440.—Coke-Oven Construction Company, Ltd., and Marr, J., "Fractionation and purification of hydrocarbons." Dec. 21.
24,532.—South Metropolitan Gas Company and Chandler, D., "Gas boiling-burners." Dec. 23.
24,574.—Thorp, F., "Pans for gas-cookers." Dec. 24.
24,597.—Harding Bros., Ltd., and Woltereck, H. C., "Production of toluol." Dec. 24.
24,598.—Pooley, H., and Fiddes, G. B., "Condensing, scrubbing, and washing gas." Dec. 24.
24,609.—Grove, W. R., "Gas-heaters for irons." Dec. 24.
24,635.—Reinert, H., "Four-stroke gas-engines." Dec. 24.
24,681.—Drakes Limited, and Drake, W. A., "Regenerative furnaces." Dec. 28.
24,713.—Hall, W. A., "Extracting from coal, &c., the hydrocarbon volatile matter." Dec. 29.
24,756.—Kent-Johnston, A. G., "Controller for distance lighting." Dec. 30.
24,782.—Chappell, D. J. & D., sen., and Benjamin, I., "Preventing fraud in connection with gas-meters." Dec. 30.
42.—Bonecourt Waste Heat Boiler Company, Ltd., and Kirke, P. St. G., "Generation of steam." Jan. 1.
85.—Duckham, A. M'D., "Discharging coke-hoppers." Jan. 2.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments Vacant.

Draughtsman. Drakes Limited, Halifax.
General Foreman. No. 5975.
Working Foreman. Calne Gas and Coke Company.
Mechanic. Isle of Thanet Gas Company.
Meter Fixer, Gas Fitter, and Maintenance Men. No. 5972.
Stoker. Holmforth Gas-Works.

Appointment Wanted.

Representative (Engineers). "Energetic," 299, care of Deacons.
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Particulars to "Principal," Scripps's Advertising Offices, 13, South Molton Street.

Plant, &c. (Second-Hand), for Sale.

Gasholder (including Dismantling, &c.). Walsall Gas Department. Tenders by Jan. 22.
Gasholder. No. 5973.

Sales of Stocks and Shares.

Ascot District Gas and Electricity Company. London Mart. Jan. 19.
Bournemouth Gas and Water Company. London Mart. Jan. 19.
Broadstairs Gas Company. London Mart. Jan. 19.
Colombo Gas and Water Company. London Mart. Jan. 19.
Redditch Gas Company. Grand Hotel, Birmingham. Jan. 28.
Tottenham District Light, Heat, and Power Company. By Tender. Jan. 19.
Worthing Gaslight Company. London Mart. Jan. 19.

TENDERS FOR

Carbonizing Plant.
Keighley Gas Department. Tenders by Jan. 20.

General Stores, Tools, &c.
Ossett Corporation. Tenders by Feb. 1.

Pipes (and Laying).
Salford Gas Department. Tenders by Jan. 21.

Meeting.
Tottenham District Light, Heat, and Power Company, 639, High Road, Tottenham. Feb. 6, Three o'clock.

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LARGEST SALE OF ANY OXIDE.

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"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
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Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Lysol, Sulphate of Ammonia.

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SPECIALLY prepared for Sulphate of AMMONIA Makers by
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THE very best Patent Grids for Holding Oxide Lightly.
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Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1915 are reminded that this can only be done during the current month.

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FOR Gas-Works Plant of Every Description; also SULPHATE OF AMMONIA and SULPHUR RECOVERY PLANTS.

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PATENTS AND TRADE MARKS PUBLICATIONS: "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 & 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
FIRTH BLAKELEY, SONS, AND COMPANY, LIMITED, Church Fenton, near LEEDS.

JOHN RILEY & SONS, Limited, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 years. References given to Gas Companies.

TAR WANTED.

THE Burnden Tar Company (Bolton), Ltd. HULTON CHEMICAL WORKS, BOLTON.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We Guarantee promptness with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: "SATURATORS BOLTON." Telephone 0848.

CLERK (27) seeks Situation. Four Years' Experience in Distribution Department of an important Gas Company.
Address, No. 5974, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

GENTLEMAN with Experience and Technical Knowledge is open to REPRESENT Firms Manufacturing or Selling Gas-Works, Water-Works, Engineers, Local Authorities, and Colliery Requirements; also Steel Constructional Work.
Address "Energetic," 299, care of Messrs. DEACONS, 7, LEADENHALL STREET, E.C.

DRAUGHTSMAN.

WANTED—An Experienced and Reliable DRAUGHTSMAN accustomed to General Gas-Plant and Structural Steelwork.
Apply, giving Particulars of Experience, &c., to DRAKES LIMITED, HALIFAX.

WANTED—A Working Foreman with Good All-Round Experience. Must have knowledge of Main and Service Laying, Fitting and Meter Fixing, &c., and Sulphate Plant. Wages 30s. per Week, with House, Coal, and Gas.
Apply, by Letter, with *copies* of Testimonials, to W. G. ARCHARD, Secretary, Gas and Coke Company, Limited, Calne, WILTS.

GENERAL Foreman.—First-Class Fully-Qualified Man (South of England) thoroughly Experienced with Electrically Equipped Stoking Machinery and Coke Handling. Must be excellent Carbonizer and appreciate the Maintenance of even Quality. Carburetted Water Gas and Sulphate Manufacture. Strict Disciplinarian and Punctual Timekeeper.
Applications, stating present Position, past Experience, Wages required, with *copies* of Three recent Testimonials (one from present employer). Good Residence and Garden, free Rates and Water.
Apply, by letter, to No. 5975, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

ISLE OF THANET GASLIGHT AND COKE COMPANY, MARGATE.

WANTED, a First-Class Mechanic, accustomed to the Repair and Maintenance of the usual Gas-Works Machinery. Knowledge of Electrical Plant desirable. Must be able to use Lathe and other Machine Tools. None but Sober, Intelligent, and Capable men need apply.
Applications, with *copies* of recent Testimonials, stating Age, Experience, and Wages required, to be sent, without delay, to the undersigned.
J. M. CAMPBELL,
Engineer and General Manager,
Gas Offices, Addington Street, Margate,
Jan. 6, 1915.

WANTED, for a 35 Million Works, a STOKER. Good Shovel Charger, used to Boilers, Exhausters, Engines, and Pumps. Eight-Hour Shifts all year. Wages 40s. Winter, 38s. Summer, with Seven Days Holiday. Steady, Married Man preferred.
Apply, stating Age, Height, and earliest date could commence Work, to the MANAGER, Gas-Works, Holmfirth, YORKS.

WANTED—A Thoroughly Experienced GAS-METER FIXER; also GAS-FITTER and Two Good MAINTENANCE MEN, used to Cleaning and Adjusting Incandescent Burners, by a Gas Company in West Riding of Yorkshire.
Apply, by letter, stating Wages Required, to No. 5972, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

ADVERTISER is prepared to Pay a Commission to anyone Introducing a SMALL GAS-WORKS that can be PURCHASED for Cash, where there is Scope for Development.
Particulars in Confidence, or write for interview to "PRINCIPAL," Scripps's Advertising Offices, 13, SOUTH MOLTON STREET, W.

BOROUGH OF WALSALL.
(GAS DEPARTMENT.)

GASHOLDER FOR SALE.

THE Gas Committee invite Tenders for DISMANTLING and REMOVING existing Three-Lift GASHOLDER, 1½ Millions capacity. Can be inspected at the Pleck Gas-Works, Walsall, by Application to the undersigned.
Tenders to be Delivered by the 22nd inst., endorsed "Removal of Gasholder."
The lowest or any Tender not necessarily accepted.
B. W. SMITH,
Engineer and Manager.
Gas-Works, Pleck,
Walsall, Jan. 9, 1915.

GASHOLDER For Sale. Capacity 6000 cubic feet. The Holder is in Good Condition, and a low price would be accepted for a quick Sale.
Address No. 5973, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

KEIGHLEY CORPORATION.
(GAS DEPARTMENT.)

TO CONTRACTORS FOR THE ERECTION OF CARBONIZING PLANT.

THE Gas Committee of the Keighley Corporation invite TENDERS for the Re-Construction of the CARBONIZING PLANT in the No. 2 Retort-House at their Thwaites Works, in accordance with Drawings and Specification—prints of which may be obtained at the Gas Engineers' Office, Cook Lane, on payment of a charge of £1 1s. (not returnable). The Site may be inspected and any Information required obtained, on application to the undersigned.
Tenders to be Delivered not later than 5.30 p.m. on Wednesday, the 20th inst.
The lowest or any Tender will not necessarily be accepted.
By order,
W. BAILLIE,
Engineer and Manager.
Gas Offices, Cook Lane,
Keighley, Jan. 9, 1915.

SALFORD CORPORATION.
(GAS DEPARTMENT.)

TENDERS invited by Three p.m. on Thursday, Jan. 21, 1915, for the Supply and Laying of 12-inch, 6-inch, and 3-inch WROUGHT-IRON or STEEL HIGH-PRESSURE GAS-MAINS with Welded Joints.
Sealed Tenders, endorsed "Tender for High-Pressure Gas-Mains," to be Delivered to undersigned.
Full Particulars from Mr. William W. Woodward, Engineer, Gas Offices, Bloom Street, Salford.
L. C. EVANS,
Town Clerk.

BOROUGH OF OSSETT.

THE Corporation of Ossett invite TENDERS for the Supply of MATERIALS, STORES, WORKMEN'S TOOLS, &c., required in the Highways, Gas, Lighting, Water, Sanitary, and Educational Departments for One Year from the 1st of April, 1915, to the 31st of March, 1916.
Specification and Forms of Tender may be obtained at the Borough Surveyor's Office on Application.
Sealed and endorsed Tenders to be Delivered to me the undersigned at the Town Hall, Ossett, not later than Ten a.m. on the 1st day of February, 1915.
The Corporation do not bind themselves to accept the lowest or any Tender.
T. W. WILSON,
Town Clerk.
Town Hall, Ossett,
Jan. 7, 1915.

EUROPEAN GAS COMPANY, LIMITED.

NOTICE is Hereby Given to Holders of Share Warrants to Bearer that an INTERIM DIVIDEND OF FIVE PER CENT.—viz., 10s. per share—WILL BE PAID, free of Income-Tax, on the 1st of February next. This payment is, however, subject to a deduction of 6d. per Share for French Stamp and Transfer Duty.
Payment will be made at the Union of London and Smiths Bank, Limited, 2, Princes Street, London, E.C., after Serial Coupon No. 80 has been left there Three Clear Days for Examination.
And NOTICE IS HEREBY FURTHER GIVEN that the TRANSFER BOOKS WILL BE CLOSED from the 11th to the 19th inst., both days inclusive.
W. B. BRADY,
Secretary.
Finsbury House, Blomfield Street,
London, E.C., Jan. 6, 1915.

TOTTENHAM DISTRICT LIGHT, HEAT, AND POWER COMPANY.

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be Held at the Company's Offices, No. 639, High Road, Tottenham, on Saturday, the 6th day of February, 1915, at Three o'clock in the afternoon precisely, to receive the Directors' Report and Statement of Accounts for the Half Year ended Dec. 31, 1914; to declare Dividends; and to transact the General Business of the Company.
The TRANSFER BOOKS for the "A" and "B" CONSOLIDATED and PREFERENCE STOCKS WILL BE CLOSED from Saturday, Jan. 23, to Saturday, Feb. 6, both days inclusive.
By order of the Board,
E. TOPLEY,
Secretary.
Chief Offices of the Company,
639, High Road, Tottenham,
Jan. 7, 1915.